The Analyst,

INCLUDING THE PROCEEDINGS OF

THE "SOCIETY OF PUBLIC ANALYSTS."

MONTHLY JOURNAL FOR THE INFORMATION OF THOSE INTERESTED IN THE PURITY OF FOOD AND DRUGS, AND IN GENERAL ANALYTICAL AND MICROSCOPICAL RESEARCH.

EDITED BY

G. W. WIGNER, F.I.C., F.C.S., LONDON AND AMERICA,

ONE OF THE

Hon. Secretaries of the Society of Public Analysts;

AND

J. MUTER, Ph.D., F.I.C., F.C.S.,

Vice-President of the Society of Public Analysts.

VOL. VI.

1881.

LONDON:
Published for the Proprietors, by Messrs. BAILLIÈRE, TINDALL & COX,
King William Street, Strand, W.C.

- 19006 -

LONDON:

J. DAVIS, PRINTER, STEAM WORKS, 201, OLD KENT ROAD.

INDEX.

T

U

V

W

THE ANALYST.

JANUARY, 1881.

SOCIETY OF PUBLIC ANALYSTS.

The Annual Meeting of the Society will be held at Burlington House on Wednesday, the 19th inst. The Annual Dinner will take place the same evening. The customary circular, with particulars, will be sent to Members as usual.

NOTE ON THE METHOD OF CALCULATING THE QUANTITY OF ADDED WATER IN DILUTED SPIRITS.

By A. Ashby, M.B., F.R.C.S.

The excellent alcohol tables compiled by Mr. Hehner, and by Dr. Stevenson, give us a ready way of calculating the exact quantity of water which must be added to spirit of any known strength in order to reduce it to any other, found or wished for, by using, in conjunction with them, the formulæ I am about to propose. The analyst can thus readily state the amount of water which has been added to spirit of the lowest strength allowed by the Sale of Food and Drugs' Act Amendment Act in any adulterated sample which may come under his notice, whilst the spirit merchant can as easily calculate how much water he must mix with a spirit of any known strength in order to reduce it to any other he may desire.

Let us presume that we have an adulterated sample of gin 45 under proof, and that we want to state how much water has been added to gin of the limited strength of 35 u.p. On referring to the tables it is seen that spirit of the latter strength contains 37·14 per cent. by volume of alcohol; consequently it has 62·86 per cent. of water by volume.

Now let us add an unknown quantity of water to this spirit, which may be represented by X. The volume of the diluted spirit will be 100 + X; and the percentage of alcohol by volume in it will be—(100 + X) : 100 : : alcohol by vol. per cent. at 35 u.p. : alcohol by vol. per cent. in diluted spirit.

The latter is the strength of the spirit found by analysis, which in gin 45 u.p. is 31·4. Then—

$$(100 + X) \times \text{alcohol by vol. per cent. found} = \text{alcohol by vol. per cent. at 35 u.p.} \times 100;$$

$$\text{and } X = \frac{\text{Alcohol by vol. per cent. at 35 u.p.} \times 100.}{\text{Alcohol by vol. per cent. found}} - 100;$$

and in the example taken—

$$X = \frac{37{\cdot}14 \times 100}{31{\cdot}4} - 100 = 18{\cdot}28.$$

So that in the adulterated sample 18·28 parts by measure of water have been added to 100 parts by measure of gin of the lowest strength allowed by law.

In the case of brandy, whiskey, or rum, it will be necessary to use the following formula—

$$X = \frac{\text{Alcohol by vol. per cent. at 25 u.p.} \times 100}{\text{Alcohol by vol. per cent. found}} - 100,$$

since 25 under proof is the limit of reduction assigned by the Act to those spirits.

Similarly, by the use of the following formulæ, and the alcohol tables already alluded to, the spirit merchant can ascertain how to reduce a spirit from any known strength to any other he may desire. Thus:—

$$X = \frac{\text{Alcohol by vol. per cent. at present strength} \times 100}{\text{Alcohol by vol. per cent. at desired strength}} - 100.$$

Suppose, for example, that it is desired to reduce brandy from 1 o.p. to 12 u.p.; then on referring to the tables, and using the above formulæ, we shall have—

$$X = \frac{57{\cdot}64 \times 100}{50{\cdot}21} - 100 = 14{\cdot}79.$$

So that to 100 parts of brandy at 1 o.p. 14·79 parts of water must be added in order to reduce it to 12 u.p.

By substituting the percentage of alcohol by weight for that by volume in the formulæ, the relative proportions by weight of spirit and water can be ascertained if desired.

I am not aware whether these formulæ have been proposed before, but, at any rate, the use of them will demonstrate one of the numerous advantages to be derived from the complete alcohol tables by spirit merchants as well as by chemists.

A NEW METHOD FOR THE EXAMINATION OF COFFEE.

By F. M. Rimmington, F.C.S., F.I.C.

I think it will be generally admitted that the methods in use for estimating the degree of adulteration in coffee are far from satisfactory as regards definiteness and certainty, and that something more approaching to chemical accuracy is very desirable. Little has been done in this direction since the days of the *Lancet* Sanitary Commission.

It may not be generally known to analysts that chicory, dandelion and, probably, some other substances that are used for mixing with coffee, are readily deprived of colour by a weak solution of chloride of lime (hypochlorite), and that this agent has very little action on coffee. When this method is adopted, a portion of the coffee should be gently boiled a short time in water, with a little carbonate of soda, so as to remove as much extractive as possible; after subsidence the liquor should be poured off, and the residuum washed with distilled water. When this has been done sufficiently, a weak solution of the hypochlorite is to be added, and allowed to remain, with occasional stirring, until decolouration has taken place, which will probably be in two or three hours. The coffee will then form a dark stratum at the bottom of the glass, and the chicory, a light, almost white stratum, floating above it, and showing a clear and sharp line of separation. The chicory after this operation is in a fine condition for microscopical examination, and both the upper and lower strata of the deposit can be examined for other substances. Although the lower stratum may be dark coloured, and have the appearance of coffee, other substances may be present and should be looked for.

I have recently met with a substance that is entirely new to me as a coffee substitute *that is not affected* by this treatment.

NOTE ON BUTTERINE.

By Arthur Angell, F.I.C., F.C.S.

Manufacturers have now succeeded in mixing foreign fats with butter. A large quantity of a compound called "Creamy Butterine" has recently been placed upon the market. It is a palatable article, has all the appearance and odour of a butter, and is therefore very different from the "butterines" and "oleomargarines" hitherto produced. It yields 92 per cent. of insoluble fatty acids, and under the micro-polariscope shows well-defined stellate crystals, thereby proving that some part of the compound has been fused. I may here mention that genuine butters made from scalded cream are crystalline in structure.

ADULTERATION IN AMERICA.

The following is the Report of the Committee of Award in the recent Competition instituted by the American National Board of Trade:—

New York, *Oct. 27th, 1880.*

Frederick Fraley, Esq., *President National Board of Trade.*

Sir,

The Committee appointed by the National Board of Trade for the purpose of awarding prizes for the best Act or Acts, accompanied by an Essay, designed to prevent injurious adulteration, and to regulate the sale of food without imposing unnecessary burdens upon commerce, have the honour to report as follows:

In accordance with the resolutions under which the Committee was constituted, we have carefully examined the papers submitted in this Competition, and from these have selected as the three most meritorious Essays, with the accompanying Acts, numbering them consecutively in the order of merit as follows:

No. 1. The Essay and Acts having the motto, "*Æquo Animo.*"

No. 2. The Essay and Acts having the motto, "*Sic utere tuo ut alienum non laedas.*"

No. 3. The Essay and Acts having the motto, "*Overcome Evil with Good.*"

Upon opening the sealed envelopes, having corresponding mottoes, it is found that the authors of these Essays are as follows, viz.:

No. 1. Motto "*Æqua Animo,*" G. W. Wigner, F.C.S., London.

No. 2. Motto "*Sic utere tuo ut alienum non laedas,*" Vernon M. Davis, New York City, N.Y.

No. 3. Motto "*Overcome Evil with Good,*" William H. Newell, M.D., Jersey City Heights, New Jersey.

In addition to these Essays, we recommend the printing of the Essay having the motto "*Cardinal Cajetan,*" whose author is O. W. Wight, M.D., Health Officer, Milwaukee, Wisconsin; and the remarks submitted under the motto "*Work and Wait,*" by Albert B. Prescott, Ann Arbor, Michigan.

In connection with this award, the following remarks are respectfully submitted:

1. In view of the statements which for the last two or three years have from time to time been made with regard to the prevalence in this country of adulterations of food which are dangerous to health and life, and which have created so much agitation in the public mind, as to induce the National Board of Trade to establish this competition, it is

very gratifying to find that none of the essayists produce any definite or satisfactory evidence as to the widespread existence of such dangerous adulterations in this country.

The absence of such evidence, in addition to the results recently obtained by several expert chemists in extensive series of analyses of the usual articles of food in this country, which results have been made known to the committee, fully warrants us in declaring that none of our staple articles of food or drink are so commonly adulterated as to be dangerous to health or life. Such dangerous adulterations appear to be mainly in the form of poisonous colours or colouring matters, as, for instance, in confectionery, and even these are rare.

2. The question of the adulteration of food, with perhaps the exception of milk, should therefore be considered not so much from a sanitary standpoint as from that of commercial interests; as being of the nature of a fraud, in aiding the sale of articles which are not what they are represented to be. The main objects of legislation upon this subject should be to prevent deception, to furnish to the public authoritative information, and to nullify the operations of ignorant and sensational alarmists, who damage the business interests of the country quite as much as do the evils of which they complain.

3. We are of the opinion that there is much more danger to health and life in this country from adulterated drugs, than there is from adulterated food, and that any legislation which is to deal with the one should also deal with the other.

4. To indicate the legislation upon the adulteration of food and drugs, which will protect health and prevent fraud, and at the same time not impose unnecessary burdens upon trade is a matter of very great difficulty, as the result of this competition clearly shows, for we do not consider any of the Acts proposed to be satisfactory. In this matter it is much better at first to do too little than too much, and the first steps in such legislation should be tentative and educational in character.

5. While it is highly desirable that the general principles of legislation on this subject should be the same in all States, we do not think it possible to secure by State laws absolute uniformity in the details in all parts of this country, and it would therefore be unwise to make the attempt.

6. We do not think that any law upon the adulteration of food and drugs can be made efficient without a properly constituted health authority to supervise its execution. The questions involved are in a high degree technical, and require special training in those charged with administering the law. At the same time we think that the existence of such health authorities should be taken for granted in the Acts and that these should not attempt to create them.

We believe that every State should have a Board of Health, but that such Boards should be created by independent legislation.

7. We think it unadvisable that the law should attempt to define in detail as to what an adulteration is. A very considerable amount of discretion should be left to the Board of Health in this respect, limiting it only in the direction of possible over-rigidity. Many well recognized articles of commerce, although harmless and even useful, may be said to be adulterated, and it should be left to the discretion of the Board to exempt any article from the penalties imposed in the Act.

8. Care should be taken not to make the penalties excessive. It should be remembered *that mere exposure* of fraudulent practices, if effectually and persistently made, is in itself

a penalty, and as a rule public opinion may be trusted to make such practices unprofitable if measures be taken to make this opinion a correct one, which we think should be the great object of the law proposed.

Under no circumstances should fees or moieties to informers be allowed.

9. We think that both State and National laws upon this subject are desirable. The State law should deal with the subject in the individual State. The National law should deal with adulterated articles coming from foreign countries, or passing from one State into another, and also with adulterations in the Territories, the District of Columbia, and in all places under the special jurisdiction of the United States. It is, of course, in the highest degree desirable that the State and United States legislation on this subject should not be discordant.

The educational feature should be even more prominent in the National than in the State law, while the punitive feature should, if anything, be less severe. As the State laws will vary somewhat in this last respect, it follows that the penalties in the United States law should be at a minimum.

10. The Committee will endeavour to prepare and to place in the hands of the President of the National Board of Trade as soon as possible drafts of Acts, prepared in accordance with the general principles contained in this report.

All of which is respectfully submitted.

(*Signed*) JOHN S. BILLINGS,
C. WILLIAMSON,
C. F. CHANDLER,
A. H. HARDY, } *Committee of Award.*

The Definition of an Adulterated Article, and the Principal Clauses of the Draft Act proposed in the Essay by Mr. WIGNER, are as follows:—

An Article shall be deemed to be Adulterated within the meaning of this Act.

A.—*IN THE CASE OF DRUGS.*

1. If, when sold under or by a name recognised in the U.S. Pharmacopœia, it differs from the standard of strength, quality, or purity, laid down therein.

2. If, when sold under or by a name not recognised in the U.S. Pharmacopœia, but which is found in some other Pharmacopœia, or other standard work on *Materia Medica*, it differs materially from the standard of strength, quality, or purity laid down in such work.

3. If its strength, or purity, fall below the professed standard under which it is sold.

B.—*IN THE CASE OF FOOD OR DRINK.*

1. If any substance, or any substances, has, or have been mixed with it, so as to reduce, or lower, or injuriously affect its quality, strength, purity, or true value.

2. If any inferior or cheaper substance, or substances, have been substituted wholly, or in part, for the article.

3. If any valuable constituent of the article has been wholly or in part abstracted.

4. If it be an imitation of, or be sold under the name of another article.

5. If it consist wholly or in part of a diseased, or decomposed, or putrid, or rotten animal or vegetable substance, whether manufactured or not; or in the case of milk, if it is the produce of a diseased animal.

6. If it be coloured, or coated, or polished, or powdered, whereby damage is concealed, or it is made to appear better than it really is, or of greater value.

7. If it contain any added poisonous ingredient, or any ingredient which may render such article injurious to the health of a person consuming it.

LIMITS.

The following shall be deemed limits for the respective articles referred to :—

Milk shall contain not less than 90 per cent. by weight of milk solids, not fat, and not less than 2·5 per cent. of butter fat.

Skim milk shall contain not less than 9·0 per cent. by weight of milk solids, not fat.

Butter shall contain not less than 80·0 per cent. of butter fat.

Tea shall not contain more than 8·0 per cent. of mineral matter, calculated on the tea dried at 100° C., of which at least 3·0 per cent. shall be soluble in water, and the tea as sold shall yield at least 30·0 per cent. of extract.

Cocoa shall contain at least 20 per cent. of cocoa fat.

Vinegar shall contain not less than 3·0 per cent. of acetic acid.

It will be seen that in the case of drugs sold under names found in the U.S. Pharmacopœia, this definition allows of no deviation, either by increase or decrease of strength, quality or purity.

As to drugs not called official, it appears desirable to allow some slight variation, because different standard authorities do show slight discrepancies, and therefore, in that case, the words I have used are "differs materially."

AS TO FOOD AND DRINK.

The watering of milk is provided for by Nos. 1 or 2, the skimming of milk by No. 3, which also provides against the sale of partly exhausted coffee or tea. The sale of butterine under the name of butter by No. 4.

Milk from diseased cows, pickles made from rotten vegetables, or rancid or putrid butter are provided for by No. 5, and the refacing of tea or polishing of coffee and pepper, and the case of hams coloured externally with chromate of lead, &c., by No. 6.

The admixture of chicory with coffee, potato starch with arrowroot, damaged flour with sound flour, and other similar adulterations, are provided for by No. 2, and the undue watering of spirits by No. 1 or No. 2; and bad spirits containing large quantities of fusel oil, or beer containing "cocculus indicus," or other injurious constituents by No. 7, which also provides for the presence of lead or poisonous metals in tinned goods.

This definition is purposely drawn in the most stringent form, because all exceptions which should be made in order to prevent the Act from bearing with undue pressure upon honest tradesmen, or from hampering manufacturers, are the better made in the Act itself, and not in the definition.

The definition should meet every possible case of fraud or carelessness, and the Act must provide relief from its stringency wherever that relief is needed.

Appended to the definition, it will be desirable to have the table of limits, which may, perhaps, at a future time be extended with advantage, showing the degree of richness or quality required in certain articles. This should be inserted as a separate schedule to the Act, and power should be given to the State Board of Health, as provided in the draft Act,

to add to, take from, or alter these limits from time to time as may be found desirable, due notice being given to the public of any such alteration.

APPENDIX A.

PROPOSED DRAFT OF A NATIONAL ACT, BY MR. WIGNER.

An Act to Prevent the Adulteration of Food and Drugs, or the Sale of Adulterated Articles of Food or Drugs.

Whereas it is reported that adulterated or spurious articles of food and drugs are manufactured, imported or sold within the United States; and also that damaged or diseased articles of food or drugs are manufactured, imported or sold; and whereas, in order to prevent injury to the public health, or fraud, injury, or prejudice or loss to the purchaser of such articles as those hereinbefore referred to, it is desirable to suppress such practices.

Be it enacted :

For the purpose of this Act the definition of an adulterated article shall be that which is given in Schedule A of this Act, and wherever an adulterated article is herein referred to the phrase shall be interpreted in accordance with that definition.

The term "food" shall include every article used for food or drink by man, except water.

The term "drug" shall include all medicines for internal or external use.

State Boards of Health shall be constituted, which shall consist of at least one analyst, one physician, one barrister, and one retired merchant. No member of these boards shall, while acting as such, be directly or indirectly engaged in the sale of food or drugs.

The first members of such boards shall be appointed by the House of Representatives of each State, and they shall be appointed for three years.

The members of this board shall be remunerated for their services at the rate of ....dollars.

The first duty of each of these boards shall be to appoint a public analyst, or public analysts, and an inspector or inspectors, and to arrange for the payment of their remuneration. The remuneration of public analysts shall consist of an annual salary not exceeding .... dollars, and the sum of........ dollars per sample analyzed. When a public analyst is called to give evidence in any case, he shall receive, in addition, the sum of ....dollars per day and his travelling expenses. The public analyst shall be appointed for a term of not less than three years. The State board may, if they think desirable, provide and furnish a laboratory for him. The remuneration of the inspectors shall consist of a sum not exceeding ....dollars per annum, and the sum of........dollars per day travelling expenses when actually travelling on his business. Every inspector so appointed may appoint a deputy to act for him when desirable, at a salary of ....dollars.

Every public analyst so appointed shall be an analyst who has been in actual practice for two years, and who is skilled and has had practical experience in chemical and microscopical analysis.

Every inspector to be so appointed shall be a man of due experience and discretion, and the choice shall by preference be made from those who have already had experience in other sanitary work.

It shall be the duty of each inspector appointed under this Act, from time to time, to procure samples of every article of food or drink or drugs exposed for sale, or on sale, in any street or shop, or store, or other place, or being delivered to consumers, and to submit these samples to the public analyst for analysis. In purchasing these samples the inspectors shall, as regards the class of goods purchased and the time of purchase, act under the direction of the public analyst, subject to any control by the State boards. The number of such samples shall not, in any district or township, be less than one per annum per thousand of the population.

When an inspector has purchased any sample, he shall divide it into two portions, each of which shall be sealed with an official seal. Should the vendor request it, he shall be at liberty to affix his own seal to each parcel. The inspector shall forthwith transmit one portion of the sample by mail, express, or otherwise to the public analyst, or shall personally deliver it to the public analyst, and shall retain the other sealed portion of the sample until he receives the certificate of the analysis thereof, or in case the sample prove to be an adulterated one, until the case has been heard and decided by the Court.

It shall be competent for any purchaser of any article of food, drink, or drugs, who may suspect the same to be adulterated, to submit the same to the public analyst for analysis, upon payment of a fee of three dollars per sample, but it shall be the duty of the purchasers in such case to sign a declaration stating where and of whom the sample was purchased, and the price paid for it, and the name under which it was sold.

It shall be the duty of the analyst to analyze or examine all samples submitted to him by the inspectors or purchasers as aforesaid, and to report upon them by a certificate, on a form similar to that given in the schedule to this Act.

The said certificate shall be *prima facie* evidence in any Court, so that the attendance of the analyst may be dispensed with. It shall be the analyst's duty to state in this certifiate whether the article is adulterated or not adulterated, according to the meaning of this Act, and if it is so adulterated he shall state, as far as practicable, the nature and percentage of that adulteration, and whether the same would render the article injurious to health, and whether the same is so small in quantity as to render it desirable not to prosecute for a first offence, together with any other observations he may think it desirable to make.

From and after the passing of this Act no person shall, except as hereinafter provided in Section 11, sell or offer or expose for sale, or deliver any adulterated article, either in the streets or in any store or market or shop, or stall, or other place of business, or on a round from house to house, under a penalty for the first offence not exceeding 50 dollars, for the second offence a penalty not exceeding 100 dollars, and for the third and subsequent offences a penalty not exceeding 250 dollars, and in addition to the latter penalty the Court shall, in the case of a third offence, order the publication of the name and address of the vendor, and of the fact of his having been twice or more frequently previously convicted in the local or district papers at his own cost. But if the certificate of the public analyst shall state that the sample has been so adulterated as to be injurious to health, the court is hereby empowered to increase the penalty imposed to any sum not exceeding five times the amount of the maximum penalty laid down for first, second, and third offence.

The fines and other payments shall be applied towards the expenses incurred under this Act.

Notwithstanding the preceding sections of this Act, it shall be lawful to sell any admixtures of substances or substitutes for substances, such as are already recognized as ordinary food products, provided that the same are not injurious to health, and that the vendor by himself or his servants makes a declaration of admixture to the purchaser at the time of, or prior to the delivery of the article, either by means of a label affixed to the sample stating distinctly that the substance is a mixture, or by a verbal declaration that the article is sold as a mixture.

The limits attached to the definitions, and forming Schedule B of this Act shall, in the first instance, be taken as the limits of strength or purity of the various articles therein enumerated, but it shall be competent for the State Board of Health from time to time to revise the figures therein contained, or to add other limits to them.

Every person selling, or offering or exposing any article of food or drugs for sale, or delivering any article to purchasers, shall be bound to serve or supply any inspector appointed under this Act who shall apply to him for that purpose, and on his tendering the value of the same, with a sample sufficient for the purpose of analysis of any article which is included in this Act, and which is in the possession of the person selling, under a penalty not exceeding 50 dollars for a first offence, and 100 dollars for a second and subsequent offences.

Each analyst shall submit a quarterly report to the State Board of Health, giving the results of all the analyses made by him during the preceding quarter, and these reports shall be published either quarterly or annually.

The analysts appointed by the various States shall from time to time meet and decide upon the most suitable and efficient processes for the various analyses to be made. These processes shall be submitted to the State Board of Health, and after receiving their sanction they shall have the force of a Schedule to this Act, until again amended by the analysts so assembled, and the amendment confirmed by the State Board.

No public analyst shall give a certificate of the adulteration of any article of food or drugs, unless he has worked according to one of these processes.

The Second Essay, by Mr. V. M. Davis,

Contains no Definition of Adulteration, but the Principal Clauses of the Proposed Act are as under:—

Section I.—The term food and drink shall include every article used by man as food and drink, except drugs and water.

Section II.—The term adulterated food and drink shall include any article of food and drink to which there has been added any foreign substance or substances, whose presence is not acknowledged in

the name under which said articles of food and drink are sold, whereby loss to the purchaser, deception of the purchaser, or concealment from the purchaser of the true quality of the article results.

SECTION III.—No person shall manufacture, or have for sale, offer for sale, or sell within the State, any article of unwholesome, deleterious or adulterated food or drink, under a penalty of one hundred dollars for the first offence and three hundred dollars and imprisonment for one month for each succeeding offence.

SECTION IV.—No person shall manufacture, or have for sale, offer for sale, or sell within the State, any article of food or drink which has been colored, stained, coated, faced, or otherwise treated in such a way as to conceal from the purchaser its real value or quality; unless such staining, coloring, coating, facing, or other treatment is acknowledged in the name under which the said article of food or drink is sold;—under a penalty of one hundred dollars for the first offence, and three hundred dollars and imprisonment for one month for each succeeding offence.

SECTION V.—Any person or persons who shall color or stain, or cause to be colored or stained, any article of confectionery with chrome yellow or chromate of lead, Prussian blue, arsenite of copper, red oxide of lead, or other deleterious or injurious substances; and any person or persons who shall have for sale, offer for sale, or sell within the State, any article of confectionery so colored or stained, shall be fined two hundred dollars for the first offence, and four hundred dollars and imprisonment for two months for the second and each succeeding offence; except it shall be that those articles of confectionery, so colored or stained, were so colored or stained for purposes other than sale or consumption.

SECTION VI.—No person shall abstract or remove, either wholly or in part, any ingredient from any article of food or drink; nor shall any person have for sale, offer for sale, or sell within the State as the pure article, any article of food or drink from which any ingredient has been so abstracted or removed; except such abstraction or removal be for purposes of purification, or of otherwise improving the quality or condition of said article, under a penalty of one hundred dollars for the first offence, and three hundred dollars and imprisonment for one month for each succeeding offence.

SECTION VII.—No person shall have for sale, offer for sale, or sell within the State, any adulterated milk, or milk to which water or any foreign substance or substances has been added; nor shall any person have for sale, offer for sale, or sell as pure milk, milk from which the cream has been removed, either wholly or in part, under a penalty of one hundred dollars for the first offence, and three hundred dollars and imprisonment for one month for each succeeding offence.

SECTION VIII.—No person shall have for sale, offer for sale, or sell within the State, as pure butter, any article made either wholly or in part of animal or other foreign fats, under a penalty of one hundred dollars for the first offence, and three hundred dollars and imprisonment for one month for each succeeding offence.

SECTION IX.—Ignorance on the part of any person or persons having for sale, offering for sale, or selling, any article of food and drink, of the true quality or character of the food or drink so held for sale, offered for sale, or sold, shall not constitute a defence, or be received as such in any action brought for the violation of any of the foregoing provisions, or all of them.

SECTION X.—The names and addresses of any person or persons who shall be convicted of violating any of the sections of this Act, shall be printed once for each offence, together with the particulars of the offence, in two of the prominent newspapers published in the county where the offence was committed.

SAFETY CHEQUES.

MR. A. A. NESBIT, F.C.S., has recently patented an invention which has for its object the prevention of forgery in connection with the alteration of cheques. The method which Mr. Nesbit proposes is, we believe, a step in the right direction, and will probably, if adopted, diminish to a considerable extent the chances of forgery. The invention consists in using paper coloured or stained with an acid or alkaline dye, which dye is sensible to the action of either acid or alkali. The paper so stained is printed with a colourless acid or alkaline ink, so that the effect produced is an acid or alkaline writing upon a ground coloured with a sensible dye having a different reaction; so that when an attempt is made to alter the printing the effect produced is that the difference between the colour of the printing and that of the ground is destroyed and the printed inscription rendered illegible.

CORRESPONDENCE.

[The Editors are not responsible for the opinions of their Correspondents.]

LARD ADULTERATION.

To the Editor of "The Analyst."

Sir,—Has any investigation been made with regard to the adulteration of lard? I find that all lard sold by grocers is of a very inferior quality when compared with the pure article. My attention was first drawn to the matter through pastry being hard and tough when shop lard was used. On comparison of melting points I find the following:—

Pure home-rendered lard	112° F.
Chemists' prepared lard	113°
Grocers'— 1	106°·5
" 2	96° (American)
" 3	95°
" 4	103°
" 5	102°

What is the probable adulterant? Mangosteen oil? No other animal fat, except butter, has so low a melting point.

The selling price of these lards is 7d. and 8d. per lb.; chemists' is 11d., and rendering one's own lard costs 10½d., the pig's leaf being 8d. per lb. at the butcher's. To sell lard at 7d., therefore leaves a margin on the wrong side for profit.

I am, &c.,

Rugby, *Dec. 4th*, 1880. A. PERCY SMITH.

LAW REPORTS.

Butterine Sold for Butter.—Defendant Cautioned:—

At the Northern Divisional Police Court, Dublin, Edward O'Beirne, of 31, Talbot Street, was summoned for having, on September 18, sold as butter, the substance known as butterine. The certificate of Dr. Cameron, City Analyst, set forth that the stuff in question submitted to him for analysis was a compound of foreign fats, not butter fats. An inspector of nuisances of the Corporation, named Toller, deposed that on the day in question he went into the defendant's premises and asked for a half-pound of 10d. butter. The stuff now in question was sold him. When he announced himself an inspector, the assistant told him that it was butterine he had sold him. The "cool" from which the stuff was taken was not marked butterine, nor did witness observe any butterine labels in the shop. The assistant deposed that before he sold the butter he told the prosecutor it was butterine. It was further deposed that there was a cool of butterine marked as such, but that the label accidentally fell flat. The assistant was positive that he had stated the substance sold was butterine before the inspector said who he was. Mr. O'Donnell said he would not go into the question raised by the conflict of evidence. He would dismiss the summons with a caution, but at the same time he advised the defendant to be a little more careful in future, and to see that the cards are so placed in the shop that they will not fall down.

Another Case.—Defendant Fined:—

In the Southern Division, before Mr. Exham, Michael Kavanagh, of 46, Upper Kevin Street, was summoned for an offence similar to that alleged againtst Mr. O'Beirne. The evidence was similar. Prosecutor asked for half-a-pound of 10d. butter. The cool from which the butterine was taken was not marked butterine, but in an obscure portion of the shop, as the complainant alleged, there was a card hanging up, marked butterine. Defendant submitted that this label was in a conspicuous position in the shop, and invited inspection of it by Mr. M'Sheehy himself. He said it was by a mere catch he was made liable, when he had a label posted in his shop, and everyone knew that good butter could not be bought for 10d. a lb. Mr. M'Sheehy said that there was indeed a catch in the matter, but it was a catch on the public. Mr. Exham considered the offence proved, and fined the defendant £5.

Another Case.—Wilfully Deceiving the Public:—

James Molloy, of 80, Lower Camden Street, was charged with a similar offence. In this case the prosecutor deposed that one of the cools of butter was marked with a label on which was written *butterine*, but over the "ine" was placed a smaller card marked 10d., so that the apparent marking on

the cool was "butter, 10d." Mr. Exham considered that this proceeding was a wilful deceiving of the public—it was a very bad case, and he would impose a fine of £10.

John Connell, 36, Wexford Street, was summoned for a similar offence. In this case the defendant was fined £5, and announced his intention of appealing. He stated that it was almost his invariable rule to inform those whom he thought were not aware of the nature of butterine, exactly what it was.

Appeal.—Railway Porter not Agent of Consignor.—Consignor not entitled to one portion of sample :—
In the Queen's Bench division, the case of Rouch v. Hall came before the Court as an appeal by the Inspector of Nuisances for the parish of St. Pancras, from a decision of Mr. de Rutzen, the Magistrate of the Marylebone Police Court, on an information laid under the Sale of Food and Drugs' Act of 1875, and the Amendment Act of 1879, against the respondent, a farmer at Coventry, for the adulteration of milk consigned by him to a Mrs. Sims, a milk dealer in London.* It appeared from the case, as stated by the learned Magistrate for the decision of this Court, that the Inspector was at Euston Station on March 18th last, and saw a can containing milk being taken from the van, and which was consigned by the respondent to Mrs. Sims. He accordingly, in pursuance of the provisions of Section 14 of the Act of 1875, demanded and received a sample, which he divided into three portions, one of which he gave to the porter, treating him as the agent of the respondent, and stating at the same time that he intended to have the milk analyzed. The Inspector, however, took no steps to acquaint either the respondent or the consignee with his intention, but finding the milk was adulterated with water, laid his information. On the hearing of the summons, it was dismissed by the Magistrate, who held, in effect, that the railway porter was not the agent of respondent, and that the proceedings adopted by the Inspector were not in compliance with the Act. From this ruling the Inspector now appealed to this Court. Mr. Tickle having argued the case for the appellant, Mr. Justice Field gave judgment. He said the Court were of opinion that the appeal must be allowed. They were clearly of opinion that the railway porter was not the agent of the respondent, within the provisions of the 14th section of the Act of 1875, nor was he bound to accept a third of the sample of the milk, although he would have been liable to a penalty had he refused to supply a sample. The object of the Act was to secure to the public a supply of pure unadulterated milk, and for that purpose it was liable to seizure at the time of its being sold by the seller or his agent, and provided that a third of the small sample should be tendered to him, so that he might be enabled to have an independent analysis to show whether it was adulterated or not. But as milk had to be supplied from the country, and it was found that a hardship was often inflicted on the London seller, to whom adulterated milk was supplied by farmers, it was enacted by the Amendment Act of 1879 (42 and 43 Vic., c. 30) that the Inspector should have the power of seizing the milk at the place of delivery to the consignee. In this case the delivery had not been completed, and although the railway porter could not be held to be the agent of the consignor, the Court was of opinion that by the Amendment Act the Legislature did not intend to extend to the consignor that privilege which was afforded under the previous Act to the seller, namely, that of giving him a third of the sample to enable him to obtain an independent analysis. For these reasons the appeal would be allowed, and the case remitted to the Magistrate for judgment. Mr. Justice Manisty concurred. Judgment accordingly.

Dublin Milk.—Interesting Proceedings.—Certificate of Somerset House Chemists :—
At the Northern Divisional Police Court, on the 20th November, before Mr. O'Donnell, William Fynch, a dairyman of Upper Dorset Street, in this city, appeared in answer to two summonses charging him with selling milk adulterated with water. The case had already been before the Court. The evidence of Mr. Ballantyne, Inspector of Food and Drugs under the Corporation, was to the effect that, on September 16th, he purchased from the Defendant a pennyworth of milk. He made the usual declaration, and offered to give him a third part, but he declined to accept it. Dr. Cameron, on analysis, had certified that it contained 20 per cent. of water. Mr. O'Donnell: The defendant, then, not satisfied with Dr. Cameron's certificate, demanded a reference to Somerset House, and a special case was made upon what the ingredients should be. Mr. M'Sheehy (Law Agent to the Corporation): And it was further decided that the same cows should be milked in the presence of the Corporation Officer and a person on behalf of the accused, and that the milk then obtained should be sent to Somerset House for analysis and report, and that the report should come back to your Worship. Mr. O'Donnell: And then the result should be, if the second milk, taken in the presence of the officer, was certified from Somerset House to be of the same quality as the impeached milk, the defendant should be acquitted. Dr. Cameron :-

* *See* THE ANALYST, vol. v., p. 103.

Acquitted, no matter how it should be. Mr. Swift, solicitor for defendant: But there was this exception, that the cows should be the same as those which gave the milk analysed by Dr. Cameron. Mr. O'Donnell: I don't care. If there was any shifting, it was your client's fault. You are bound by your own acts. Mr. M'Sheehy: I understand the certificate has been received from Somerset House, but I have not seen it. Mr. Beard then stated that the questions sent to Somerset House with the second sample of milk were:—"Are the two samples of milk (Nos. 1 and 2) identical? If No. 2 is richer than No. 1, what proportion of water should be added to No. 2 to reduce the amount of solid matters in it to that in No. 1? The certificate stated the result of the analysis was—

	No. 1.	No. 2.
Per cent. of solids (not fat)..	6·44	8·90
Per cent. of solid (fat)	2·33	4·08
Per cent. of water	91·23	87·02
	100·00	100·00

"From these results it will be seen that No. 2 is much richer than No. 1 milk. After making allowances from natural loss arising from decomposition of No. 1 milk through keeping (No. 1 being fifty-three days' and No. 2 ten days' old), we are of opinion that not less than 22 per cent. of water would require to be added to reduce the solids not fat in No. 2 to the amount found in No. 1 milk." The defendant said he had sold the cow which gave the first milk, before the officer went the second time. Dr. Cameron said it was a fact, when they went to the man's house he said he had sold one cow; but three of the original cows were there. These three were milked, and all the milk mixed together. Defendant had given every facility for the proper milking of the cows. Mr. O'Donnell said there was no doubt he might be an honest man as things were going now, but he would have to pay the costs of this additional proceeding. Mr. M'Sheehy: Dr. Cameron stated he would not ask the defendant to pay the costs of the additional proceeding, in any event. Mr. O'Donnell said the defendant would have to pay the costs of the analysis by Somerset House, and he accordingly fined him £2 and £1 1s. costs. In a second case against the same defendant, the milk was purchased by Mr. David Toller, inspector, on Oct. 11th, and Dr. Cameron certified to 30 per cent. of water being in it. Defendant, who was fined £4, said he should appeal in both cases.

NOTES OF THE MONTH.

If things go as they at present appear to tend, we shall shortly have a very considerable enlightening as to the important subject of Water Analysis and standards of purity. That there is great need of seriously attacking this subject is shown by the report of Col. Bolton, the Government Water Examiner, who again this month urges the fixing of a definite standard. The Council of the Society of Public Analysts have had the matter under careful consideration for some time, and hope, by the co-operation of the members throughout the country, to be able to shortly put their scheme in force. We are glad to be able to state that nearly all the Public Analysts in England have agreed to join in working out the idea evolved by the Water Committee, consisting of Messrs. Muter, Dupré, Blyth, Hehner, Dyer, Heisch, and Wigner, and to send in regular monthly analyses of the chief water supply of their districts for publication in our columns, and communication to the Government. Of course it would be at the moment impracticable that County Analysts should supply analyses of any but the county town supply; but we trust that soon the various local authorities will be advised by their medical officers to instruct the analyst to examine and make a return of the quality of the water supply of all the various smaller towns. In this way our Society hopes to obtain reliable information on the special mineral characters of the waters of each county, and so get at the real value of several at present disputed points, notably that of the signification of the presence of nitrates in the water of any particular district. We hope to publish the first table of these analyses in our next number.

The great difficulties to be solved by the committee were, doubtless, which of the rival processes was to be adopted in dealing with organic impurity, and how the results were to be calculated; and we must confess that they appear to have solved the difficulty in a thoroughly practical manner, by adopting for the former a combination of the "albumenoid ammonia" and "oxygen consumed" processes, and for the latter parts in 70,000 (*i.e.*, grains per gallon). Looking to the fact that none of the processes actually profess to *estimate the organic* matter itself, it was of importance to select the most rapid and

reliable for such systematic analyses. Dr. Frankland's process, although very beautiful from a scientific point of view, involves the use of fragile apparatus, requiring very peculiar care in manipulation. If, therefore, the committee had adopted it, we should have had country analysts every now and then completely stopped for, perhaps, weeks, while their apparatus went up to London to be repaired. The system, moreover, takes time, wants special practice in its use, and is not suited for accurate work in a general laboratory. On the other hand, both the processes adopted may be finished within four and a-half hours, and we have the results of the one to check the other. It is true that other things besides absolutely dangerous organic matter may reduce permanganate, but, given such extensive reduction, coupled with high albumenoid ammonia, we fancy that even the most scientific advocate of "organic carbon" would think twice before he drank the water. Then again, as to the mode of reporting results, it is to be borne in mind that these statistics are to be placed before non-scientific persons, and that the metrical system has never become acclimatised in Great Britain. Persons fail to grasp millimetres per litre, but they readily comprehend grains per gallon, and they can easily see that if they drink a quart a day of such a water they would take so many grains of such an impurity. This appeals to all, and is, therefore, the natural way to state the results in this country. It is, moreover, equally suitable for analysts who use "grains" and those who employ "grammes."

It is in contemplation to continue the work, by shortly issuing definite standards of valuation, on a similar principle to that proposed some years ago in a paper on Water Analysis by Mr. Wigner; but, as this question is still under consideration by the Council, we cannot enter into it this month, farther than to say that we hope the time is not far distant when the same water sent to every Public Analyst in England will be returned with the same opinion, just like an analysis of milk or butter. A great reduction in zymotic diseases may be confidently looked forward to as the result of this.

The bankers, as well as the general business public, also will be much interested in a recent invention of a member of our Society, for giving them a cheque which cannot be tampered with. In another column will be found an abbreviation of the patent of Mr. Nesbit, whereby, by the use of litmus in printing such documents, the inventor claims to render them absolutely secure from alteration by chemical means. We hope that Mr. Nesbit's invention will be subjected to crucial tests immediately.

A milkman in Dublin being prosecuted, on the Society's standard, for adding 20 per cent. of water, brought forward all the old defences about poor cows, feed, &c., and actually challenged the milking of his cows and submitting the sample to Somerset House side by side with the condemned one. Here is the result, which had better be studied :—

	Fat.	Solids not Fat.
No. 1. Inspector's sample (53 days' old)	2·33	6·44
No. 2. Cow's—milked (10 days' old)	4·08	8·90

And the Somerset House Chemists certify that "from these results it will be seen that No. 2 is much richer than No. 1 milk. After making allowances for natural loss arising from decomposition of No. 1 milk through keeping (No. 1 being 58 days' and No. 2 10 days' old), we are of opinion that not less than 22 per cent. of water would require to be added to reduce the solids not fat in No. 2 to the amount found in No. 1 milk."

The above analysis, by the way, shows how carefully the chemists at Somerset House now work, and that they have studied the subject of milk; so that their results are in excellent accordance with those of the members of our Society.

Adulteration of Saffron.—Saffron is sophisticated with the flowers of *Calendula officinalis*, safflower, *Crocus vernus*, *Punica granatum*, fragments of sanders-wood, glucose, glycerin, oil, chalk, and heavy-spar. If *Calendula* flowers are present, it is merely needful, according to Domcier, to moisten a few flowers and rub them singly with the finger on white paper. The genuine saffron flowers give a fine, rich yellow, but the Calendula a violet reddish hue. It may also be easily detected by soaking the sample in distilled water. Real saffron retains its colour for hours, whilst Calendula looses its tint in a short time.—*Chemists' Journal.*

Soapstone.—A New Adulteration.—A firm in Cincinnatti, known as the Facing Company, are producing a powdered soapstone, which is being used by farmers and butter merchants for adulterating purposes. The article is a fine powder with neither colour nor taste, and costs about £5 a ton. A tub of butter will bear adulteration to the extent of seven or eight pounds of soapstone, and yet defy detection, as, though it increases the weight, it does not very materially affect the bulk. The merchant who made the discovery states that he was shown into a room where the adulteration process was going on, and when he tasted the pure butter and the adulterated article he could not detect the difference. The cost of the soapstone enables packers to mix it with butter at a trifling cost, whilst it gives them an additional profit of upwards of 14 per cent. It is stated that the powder is being secretly supplied to dairymen and farmers, and that the adulteration is now going on in churning-rooms. It should be said that the butter dealers are furiously indignant at being charged with adulterating their goods with soapstone. All deny the allegation, and the firm against which the strongest suspicion has been entertained offers to pay five dollars an ounce for all soapstone found in its butter.—*Provisioner.*

At a late extraordinary meeting of the Vestry of St. Marylebone, Dr. A. Wynter Blyth was appointed Medical Officer of Health and Public Analyst for the parish, *vice* Dr. Whitmore, deceased.

At a recent meeting of the Musselburgh Town Council, Mr. J. Falconer King, Edinburgh City Analyst, was appointed Public Analyst for the burgh.

RECENT CHEMICAL PATENTS.

The following specifications have been recently published, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

No. 1880	Name of Patentee.	Title of Patent.	Price
1568	W. A. Barlow	Manufacture or Extraction of Tannin	6d.
1580	E. P. Alexander	Dynamo-Electric Machines	6d.
1632	W. R. Smith and J. F. Pollock	Manufacture of Artificial Fuel	8d.
1700	T. G. Young	Production of Ammonia	2d.
1704	H. J. Haddon	Electric Lamps	6d.
1705	L. A. Davies	Liquid Compound for Electro Decomposition of Aluminium	2d.
1755	H. P. Scott, and T. D. Donaldson	Antifouling Composition for Coating Ships' Bottoms ..	4d.
1764	R. and M. Theiler	Telephone Apparatus	2d.
1767	M. L. Emmanuel	Manufacturing Oleomargarine	2d.
1771	J. H. Johnson..	Dyeing, &c.	4d.
1788	F. Brady	Treatment of certain Ferruginous Salts obtained from Iron and Steel for Coating with other Metals	4d.
1794	J. Broad	Treating Oils and Wax from Shale, Peat, &c.	6d.
1814	W. C. Locke	Amylaceous Compounds	4d.
1826	J. E. Gordon	Apparatus for producing Electric Light	6d.
1840	W. R. Lake	Production of Electric Light	6d.
1852	J. Lefranc	Manufacture of Chemical or Artificial Coal	2d.
1890	G. T. Glover	Manufacture of Ammonia and Ammoniacal Salts.. ..	2d.
1919	H. H. Lake	Manufacture of Azotic or Nitrogenous Fertilizing Compounds with a Carbonaceous Residuum	4d.
1958	J. H. Johnson	Telephonic Exchange Systems	1s. 8d.
1959	J. Hardman	Production of Anthracene from Gas Tar	2d.
1980	G. Wischin	Distillation of Anthracene from Coal Tar	4d.
2018	W. R. Lake	Manufacture of Gas	2d.
2025	W. Smith	Spirit for Use as a Detergent, Solvent, &c.	2d.
202[illegible]	R. C. [illegible]	Manufacture of Paper for Cheques	2d.
2089	B. W. Gerland	Treatment of Phosphorites, Coprolites, &c., in preparation of Soluble Phosphate or Phosphoric Acid ..	4d.
2930	J. Imray	Precipitating Solid Constituents of Sewage to Secure their Fertilizing Properties	2d.
2963	Do.	Treatment of Gas Liquor for Production of Ammonium Sulphate	2d.
2964	Do.	Apparatus for Distilling Ammoniacal Liquor	6d.
3255	Do.	Recovering Bicarbonate of Ammonia in the Ammonia Process for the Manufacture of Soda	6d.
3785	W. M. Jackson	Carburetting Gas and Air	6d.

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; Journal of Applied Science; The Boston Journal of Chemistry; The Provisioner; The Practitioner; New Remedies; Proceedings of the American Chemical Society; Le Practicien; The Inventors' Record; New York Public Health; The Scientific American; Society of Arts Journal; Sanitary Engineer of New York; The Cowkeeper and Dairyman's Journal; The Chemists' Journal; Oil and Drug News; The Textile Record of America; Reports on Water and Sewer Air, by Professor W. R. Nichols; Paper by J. Hargreaves on Sulphate of Soda.

THE ANALYST.

FEBRUARY, 1881.

SOCIETY OF PUBLIC ANALYSTS.

THE ANNUAL MEETING of this Society was held at Burlington House, on Wednesday, the 19th January, Dr. Muter in the chair.

The minutes of the previous meeting were read and confirmed.

The retiring President, Dr. Muter, delivered the following Valedictory Address :—

In accordance with our now time-honoured custom, it becomes my duty to say a few words in the form of a Farewell Address, giving a sketch of the progress of the Society under my Presidency, and of the condition in which I hand it over to my successor, who will be elected to-night. When last year you were pleased to hear from my lips that our Society had held its own in spite of the desertion of some members who were wooing a new love, how much more satisfaction will you not now feel when I tell you that since then we have made an advance in number of nearly ten per cent. Our Society is special and, consequently, exclusive, and can never be numerically large ; but we stand to-night a compact band of over 100 Members and 14 Associates, all practical men, actively engaged in the practice of Analytical Chemistry, with the entire absence of amateurs and *dilletanti*. During the year we have gained eleven new Members and one Associate, and we have to-night propositions before us from seven gentlemen desirous of becoming Members, besides a ballot for the election of one new member, and of two gentlemen recommended by the Council for election as Associates.

It is my painful duty to record that the grim tyrant, to whom we all must bow, has been busier in our ranks than heretofore, as we have to regret the death of three members, viz., Messrs. Stoddart, of Bristol ; Edger, of Newcastle ; and Dr. Proctor, of York ; all good men and true, who did their duty in life, and let us hope not without reward. Of their personal merits I would speak more fully were they not sufficiently well known to all of us. Turning now to a more pleasant theme, let me for a moment call your attention to the work done by our Society in furtherance of its great object, namely that of increasing our knowledge of proper processes for the analysis of food and drugs. I find that this goes on steadily increasing, and that during 1880, we have had the large number of 44 original communications either made to us directly or published in our Journal, THE ANALYST, as against 41 for 1879. Of these we have had five each from our Secretary, Mr. Wigner, and myself, three each from Messrs. Allen, Hehner, and West-Knights, two each from Messrs. Perkin and Smetham, and one each from Drs. Dupré, Wallace, Bartlett, Cameron, Shea, and Messrs. Wynter Blyth, Lyte, Blunt, Dyer, Harvey, and Napier, the remainder being communications printed in THE ANALYST from gentlemen outside the Society. We have also had published in THE ANALYST Mr. Wigner's usual able digest of the working of the Sale of Food and Drugs Act, some abstracts by one of our Associates, Mr. De Koningh, and last, but by no means least, Mr. Hehner's truly admirable and complete Alcohol Tables, without which no laboratory can be said to be fully furnished. I think, gentlemen, you will agree with me in saying that our Society could not put in a better claim for recognition as holding the first position in our special branch of chemistry, than is found in these statistics.

Last year our justly respected Vice-President, Dr. Dupré, made a remark to the effect that, when our work became better known among chemists generally we would receive such recognition. These remarks have proved truly prophetic, as I can say, having heard it from more than one source, that this past year has seen a marked advance in the position of our Society in the minds of those scientific chemists whose opinions count for something. We have had to struggle with much openly-declared enmity, and still more secret backbiting, and as an instance, I may mention that one of our own members even had the bad taste to advise a gentlemen not to join "a small society" like ours. The advice, however, fell flat, the gentleman in question joined us, and I notice particularly that our advice-giving member's name is conspicuously absent from the list of those who have helped by their work to show that quantity is not always synonymous with quality.

Having thus briefly shown the state in which I hand over the Society to my successor, I may I hope be excused if I express my full belief that under his reign the present good state of affairs will be more than maintained; because, if the gentleman who has been proposed be elected, as I have no doubt he will be unanimously, you will have a man far better qualified than myself to command respect both by his years and his experience, and who will, I venture to predict, fully realise our hopes raised by his past services to the Society. One word more and I have done, but that word is to be said in the most emphatic manner, as I feel it would be unjust for me to sit down without a mention of the chemists at Somerset House. Both personally and in my capacity as your President, many facts have come to my knowledge which enable me to bear public testimony to the immense pains and care exercised by Mr. Bell and his colleagues on the samples submitted to them. It is true that, in a few instances, they have been obliged to differ from the conclusions of some of our members, but they can only judge upon the sample they receive, and I am sorry to say I do not always believe the samples to strictly represent those sent to the analyst; but in most cases, where the samples were genuine, their conclusion has borne out that of the analyst. I make it purposely a point, from a sincere conviction of its truth, of making this justly complimentary reference the last of my public acts as your President. Now, gentlemen, my task is over, and in bidding you farewell, let me urge you to work, observe, and communicate your results. Chemistry is essentially a science built up by the collection of small facts, and no observation, carefully made, however apparently simple, but will aid in attaining the grand arcana. Let us then continue to prosecute researches at every spare moment, so that Great Britain may continue to be, what she is undoubtedly at present, the nursery of the science of food analysis.

Dr. Bartlett proposed, and Mr. Dyer seconded, a vote of thanks to Dr. Muter for the efficient manner in which he had conducted the business of the Society during the year, and the manner in which he had sustained the credit of the Society.

The ballot papers were opened by the Scrutineers, Messrs. Hehner and Hobbs, who reported that the following gentlemen had been duly elected as Officers and Members of Council for the current year:—

President.
C. Heisch, F.C.S., F.I.C.

Vice-Presidents.
J. Muter, Ph.D., M.A., F.C.S., F.I.C.
A. Wynter Blyth, M.R.C.S., F.C.S., F.I.C.
M. A. Adams, F.R.C.S., F.C.S.

Treasurer.
C. W. Heaton, F.C.S., F.I.C.

Hon. Secretary.
G. W. Wigner, F.C.S., F.I.C.

Other Members of the Council.
A. H. Allen, F.C.S., F.I.C.
H. C. Bartlett, Ph.D., F.C.S.
A. Dupre, Ph.D., F.R.S., F.C.S., F.I.C.
J. West Knights, F.C.S.
F. Maxwell Lyte, F.C.S., F.I.C.
J. W. Tripe, M.D.

The names of those Members of Council whose terms of office has not yet expired, and who, consequently, do not retire this year, are:—

J. Carter Bell, F.C.S., F.I.C.	Bernard Dyer, F.C.S., F.I.C.
J. Campbell Brown, D.Sc., F.C.S., F.I.C.	Otto Hehner, F.C.S., F.I.C.
C. A. Cameron, M.D., F.R.C.S., F.I.C.	W. Wallace, F.C.S., F.I.C.

The Scrutineers also reported that for the office of Second Secretary two gentlemen had received an equal number of votes.

They further reported that the following gentlemen had also been duly elected:—

As Honorary Members—Michel E. Chevreul, F.R.S., of Paris; C. Remigius Fresenius, Ph.D., of Wiesbaden; A. W. Hofmann, D.C.L., F.R.S., of Berlin. As Member—W. Hodgson Ellis, Public Analyst for District of Toronto, Canada. As Associates—W. Bouchier, Assistant to Dr. Bernays; B. A. Burrell, Assistant to T. Fairley.

The following gentlemen were proposed as Members of the Society, and will be balloted for at the next meeting:—Thomas Stevenson, M.D., F.C.S., F.I.C., Guy's Hospital; Horace Swete, M.D., F.C.S., of Worcester; W. Douglass Hogg, of Paris; Dr. Paul Vieth, of London; H. J. Yeld, M.D., F.C.S., of Sunderland; W. Johnstone, of King's Lynn, and J. J. Broadbent, F.C.S., of Charing Cross Hospital.

Dr. Muter proposed, and it was carried unanimously, that a vote of thanks be given to the Chemical Society for the use of their rooms during the past year.

A vote of thanks to the Members of Council for their services during the past year was proposed and carried unanimously, and suitably acknowledged by the Past President.

Dr. Dupré moved, and Dr. Bartlett seconded, a vote of thanks to the Secretaries for their services during the past year, which was carried.

The Annual Dinner was afterwards held at the Café Royal, Regent Street, where, notwithstanding the inclemency of the weather, many of the Members and their friends passed an agreeable evening.

The next meeting of the Society will be held at Burlington House, on Wednesday, the 16th February, at Eight o'clock.

THE ANALYSES OF THE PUBLIC WATER SUPPLIES OF ENGLAND.

The purity of the water supply of the large towns of England has been for a long time a prominent matter in the consideration of the public, and a matter of almost daily discussion in the leading London and Provincial newspapers, as well as a certain and somewhat lengthy source of argument year by year before Parliamentary Committees and in the House of Commons itself.

A certain section of the public have taken the matter up from the standpoint that a water supply for drinking purposes, ought to be not only free from all injurious constituents, but that, in order to be perfectly satisfactory, it should practically possess the characters of distilled water as far as regards freedom from either organic or inorganic constituents. Following their opinion to its logical conclusion, these persons naturally conclude that no river supply could by any chance be fit for household use, and that no matter how much the proportion of drainage matter which may find its way into a stream is oxidised, even by flowing 20 miles down the stream, its injurious effects were liable to be as bad as when it was originally poured in.

Others, again, hold that water from deep wells in the chalk strata, containing a large quantity of lime salts, although organically pure, is liable to produce, or any rate to increase, certain diseases, by introducing too large a quantity of earthy salts into the system.

It is not the business of the Society of Public Analysts to decide between these and the various other statements which have been made, but the proposals for legislation which occur from year to year in reference to water supplies, render it very desirable that authentic and reliable information as to the actual analyses of the various waters used, not only in London, but also in the leading towns of the kingdom, should be in the hands of those whose duty and interest it is to guide the national deliberations on the subject.

In order to meet this public necessity, the Society of Public Analysts have discussed the matter and decided to publish a monthly series of analyses, which shall be made on a perfectly uniform system, somewhat more full than those which have been previously in use. This series will include not only monthly analyses of the London waters, and as far as practicable all the towns included in the Registrar-General's reports, but in addition to these, periodical analyses, at longer or shorter intervals as the case may be, of the water of any other towns in which the supplies seem of a sufficiently public character, and the population is sufficiently large to justify such a step.

At present neither the Society nor its members (by whose signature the returns are authenticated) express any opinion whatever as to the relative qualities of the waters, beyond those contained in the figures and facts of the analyses themselves, although it is possible that at a future time some such expression of opinion may be made.

The details of the analyses are, however, so complete, that those who are in the habit of collating such results can form a fair judgment for themselves.

There are several special features in the scheme which require notice. The analysts who are co-operating in it are working on uniform instructions, and accordingly to absolutely uniform processes; the result is that, for the first time, a fair comparison can be made between the water supplies of London and of the provincial towns. The analyses are not only fuller than heretofore published, but some important modifications have been made, especially as regards the temperature at which the determination of oxygen absorbed is made, which, although altering these analyses slightly from those which have preceded them, yet do in the opinion of the Society greatly increase the delicacy of the analyses for the detection of pollution.

The form in which the analyses are reported, namely, by giving the results in grains per gallon, has been adopted after mature deliberation, as that which, in the judgment of the majority, would render the analyses most valuable to those who have to consult the tabulated figures.

The instructions under which the analysts are working are in print, and the Secretary will be happy to furnish a copy of them to any person interested in water analysis on receipt of a request for the same.

The Editors of this journal will endeavour, from month to month, to publish the particulars of the sources of any public supplies of which it may be possible to obtain authentic and reliable details, and some of these particulars are published in this number.

The returns for next month will probably comprise all the missing places in the Registrar-General's list of large towns, and probably some six or eight places not included among those reported on in this number.

DESCRIPTION OF THE SOURCES OF SUPPLY AND METHOD OF FILTRATION (IF ANY).

LONDON COMPANIES.

The Chelsea Company's water, Grand Junction Water Company's water, the Lambeth Company's water, the Southwark and Vauxhall Company's water, and the West Middlesex Company's water are all pumped from the Thames, but at somewhat different points. The mode of filtration also differs considerably. The following are the particulars of these supplies :—

The Kent Water Company draw their supply entirely from deep wells in the chalk. Of these there are two at Crayford, 150 feet deep, which yield over 2 million gallons per day; and an additional one, 150 ft. deep, has been sunk at Orpington. Three others at Deptford, and two at Shortlands, are 250 feet deep; and one at Plumstead is 500 feet deep. The water does not require filtration. The Company have 9 reservoirs, the whole of which are covered. The Company supplies an estimated population of 303,300 people.

New River Company draw their supply partly from Chadwell Spring, near Hertford, which produces between 4 and 5 million gallons daily; partly from the River Lea, from which (at a point also near Hertford) they take from 15 to 22½ million gallons daily; while they have also deep wells at several other places, from which large further supplies are drawn from the chalk as need requires. The subsiding and storage reservoirs for unfiltered water are capable of holding nearly 170 million gallons, and the covered service reservoirs for filtered water about 30 million gallons. The filtering beds consist of a 2 ft. 3 inches thickness of sand, or a 3 ft. thickness of gravel or other supporting material. The average rate of filtration is about two gallons per hour per square foot of filtering area. The Company supplies an estimated population of nearly one million people.

East London Company draw their supply from the River Lea, at Chingford. They have also the power of taking a certain quantity from the Thames, at Sunbury, which they occasionally exercise. The capacity of the storage and subsiding reservoirs for unfiltered water is about 605 million gallons, and of the reservoirs for filtered water 12 million gallons. The filtration is effected through sand, 2 ft. 6 inches; coarse gravel, 1 foot; boulders, 1 foot. The average rate of filtration is about 1·3 gallons per hour per square foot of filtering area. The Company supplies an estimated population of about 960,000 people.

Southwark and Vauxhall Company.—The intake is from the Thames at Hampton, almost adjoining that of the Grand Junction Company. The reservoirs for unfiltered water are capable of holding nearly 66 million gallons, and those for filtered water about 18 million gallons. The filtering material consists of Harwich sand, 3 feet; hoggin, 1 foot; fine gravel, 9 inches; coarse gravel, 9 inches. The average rate of filtration is about 1·5 gallons per hour per square foot of filtering surface. The Company supplies an estimated population of 684,000 people.

West Middlesex Company.—The intake is from the Thames at Hampton, very close to the intake of the Grand Junction Company. The reservoirs for subsidence and storage of unfiltered water are capable of holding nearly 92 million gallons, and the reservoirs for filtered water about 11 million gallons. The filter beds consist of Harwich sand, 2 ft. 3 inches; Barnes sand, 1 foot; gravel, 2 feet 3 inches. The average rate of filtration

is about 1¼ gallon per hour per square foot of filtering surface. The Company supplies an estimated population of nearly 430,000 people.

Grand Junction Company.—The intake is from the Thames at Hampton. The capacity of the subsiding and storage reservoirs for unfiltered water is nearly 64½ million gallons, and the capacity of the reservoirs for filtered water about 24 million gallons. The filter beds consist of layers, commencing from above downwards of Harwich sand, 2 ft. 6 inches; hoggin, 6 inches; fine gravel, 9 inches; coarse gravel, 9 inches; boulders 1 ft. The average rate of filtration is nearly 1⅝ gallons per hour per square foot of filtering surface. The Company supplies an estimated population of 390,000 people.

Lambeth Company.—The intake is from the Thames at Molesey. The reservoirs for unfiltered water have a capacity of 125 million gallons, and those for filtered water a capacity of about 30 million gallons. The filtering beds consist of Thames sand, 3 feet; fine gravel, 1 foot; coarse gravel, 3 feet. The average rate of filtration is 3·5 gallons per hour per square foot of filtering area. The Company supplies an estimated population of 463,000 people.

Chelsea Company.—The intake is from the Thames at Molesey. The capacity of the reservoirs for the storage of unfiltered water is 140 million gallons, and for filtered in water 11 million gallons. The filtering beds consist of Thames sand, 3 ft. 3 inches; shells, 3 inches; gravel, 4 ft. 6 inches. The average rate of filtration is about 2 gallons per hour per square foot of filtering surface. The Company supplies an estimated population of 225,000 people.

It may be convenient to tabulate the details as to these London waters thus:—

TABULATED DETAILS OF LONDON SUPPLIES.

	Kent.	New River.	East London.	Southwark and Vauxhall.	West Middlesex.	Grand Junction.	Lambeth.	Chelsea.
Capacity of Reservoirs Unfiltered..	none.	170,000,000	605,000,000	66,000,000	92,000,000	64,500,000	125,000,000	140,000,000
Filtered	,,	30,000,000	12,000,000	18,000,000	11,000,000	24,000,000	30,000,000	11,00,0000
Filter Beds......................	,,	14½ acres.	27 acres.	14·5 acres.	10 acres.	10·75 acres.	7 acres.	6·75 acres.
Fine Sand	,,	2 ft. 3 in.	2 ft. 6 in.	3 ft.	2 ft. 3 in.	2 ft. 6 in.	3 ft.	3 ft. 3 in.
Hoggin	,,			1 ft.		6 in.		
Coarse Sand	,,				1 ft.			
Shells	,,							3 in.
Fine Gravel	,,	3 ft.		9 in.	} 2 ft. 3 in.	9 in.	1 ft.	} 4 ft. 6 in.
Coarse Gravel	,,		1 ft.	9 in.		9 in.	3 ft.	
Boulders......................	,,		1 ft.			1 ft.		
Average rate of Filtration per square foot per hour	,,	2 gallons.	1·3 gallons.	1·5 gallons.	1¼ gallons.	1⅝ gallons.	3·5 gallons.	2 gallons.
Estimated Population supplied..	303,300	1,000,000	960,000	684,000	430,000	390,000	463,000	225,000
Average Quantity Pumped Daily.	8,500,000	29,000,000	26,000,000	24,000,000	10,500,000	11,700,000	16,000,000	9,000,000

PROVINCIAL TOWNS.

Cambridge.—The supply is obtained by means of a tunnel in the chalk rock, at Cherry Hinton, about two miles from Cambridge, from whence it is conveyed in cast-iron pipes, and pumped up to a covered service reservoir for the supply.

Canterbury.—This water is derived from springs in the chalk, which in this neighbourhood is about 700 feet in thickness. There are two wells, and the first water fissure tapped was at a depth of 328 feet below the surface, or 290 feet below sea level. The temperature of the water as pumped is 51° F. The water is softened by Clark's process, in tanks, holding 100,000 gallons each, and after the subsidence of the carbonate of lime, the clear water is pumped up to covered reservoirs, from whence it descends by gravitation to the city. Attempts, which will probably be successful, are being made to recalcine the deposited carbonate of lime.

Exeter.—The water is drawn from the River Exe, above the confluence of its tributary the Culme. A conduit conveys the water from thence to the pumping station, from whence it is pumped to the reservoir, filters and distributing reservoir at Danes Castle; another reservoir for the high pressure service being placed at a higher level. The supply is intermittent. The sewage of Tiverton, which is situated about 10 miles above the works, is a source of pollution to the river. The River Dart, the water of which is highly coloured with peaty matter, discharges into the Exe, near Tiverton, which again interferes with the purity. The filtering material used is Haldon sand, which is composed of coarse grains of quartz derived from the disintegration of rocks, and sand from Paignton, derived from the degradation of rocks belonging to the new red sandstone series. A sediment left on the sand is sufficient to necessitate the removal of three inches of the surface of the filtering beds every two months.

Huddersfield is supplied from Blackmoor Foot reservoir, which has a capacity of 700 million gallons. This reservoir is fed by two conduits, having a total length of about seven miles, one running from the millstone grit moorlands on the Marsden side, the other through similar moorlands on the Merton side, where it takes in a mountain stream, which supplies a large proportion of the water. The conduits are cut through beds of peat, shale and clay. The shale is in places somewhat ochrey, but the clay is remarkably free from compounds of lime and magnesia.

King's Lynn is supplied from a stream called the Gaywood River, a portion of which is diverted into the waterworks at a short distance outside the town, and drawn simultaneously through a pair of filter beds. The river which brings the water to the town is about seven miles in length, and the water is mainly derived from one great water-bearing stratum in the chalk; the river passes through the oolites, touches the upper green sands, and finally traverses the silt at Lynn.

Leeds.—The supply is collected in the valley of the Washbourne, about 15 miles north-west from Leeds; the gathering grounds are chiefly moorlands covered with peat and heather; a small portion of the land is pasture. The substrata are shale in some parts, but chiefly millstone grit.

SOCIETY OF PUBLIC ANALYSTS.

Analyses of English Public Water Supplies in January, 1881. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine.	Phosphoric Acid.	Nitrogen as Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in		Hardness, Clark's Scale, in degrees.		Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
								2 mins. at 80° Fahr.	4 hours at 80° Fahr.	Before Boiling.	After Boiling.			
Kent Co.	pale blue	slight	1·35	none	·3000	·0009	·0033	·0040	·0100	16·8°	3·8°	20·05	sand, vegetable debris	Wigner & Harland.
New River	c., faintly tinted	none	·84	traces	·2930	·0020	·0010	·0020	·0370	14·4°	4·1°	23·80	none	B. Dyer.
East London ..	greenish	none	1·35	h. traces	·0800	·0055	·0117	·0100	·0700	16·0°	7·4°	23·45	sand, vegetable debris	Wigner & Harland.
Southwark & Vauxhall ..	pale yellow	none	1.24	traces	·1690	·0005	·0050	·0020	·0440	17·5°	5·0°	23·80	satisfactory	J. Muter.
West Middlesex	c. yellow	none	1·09	traces	·2600	·0013	·0060	·0050	·0860	18·0°	4·6°	23·44	Amorphous organic matter	O. Hehner.
Grand Junction	f. yellow	none	1·12	traces	·1254	·0011	·0053	·0038	·0488	15·1°	4·0°	21·80	none	A. Wynter-Blyth.
Lambeth	marked yellow	slight	·96	traces	·1570	·0007	·0070	·0047	·1250	17·0°	4·8°	24·50	veget. debris, moving organisms	J. Muter.
Chelsea	greenish yellow	none	·95	h. traces	·1460	·0010	·0062	·0056	·0700	16·5°	7·5°	23·24	none	A. Dupré.
Birmingham ..	f. yellow	none	·98	traces	·1610	·0020		·0080	·0360	13·9°	7·1°	22·60	none	A. Hill.
Bradford	f. dirty yellow	none	·75	none	none	none	·0070	·0168	·1400	4·2°	3·7°	7·80	none	F. M. Rimmington.
Cambridge	faint blue	none	1·57	h. traces	·4030	·0007	·0021	·0039	·0616	18·5°	6·0°	24·50	none	J. West-Knights.
Canterbury	clear blue	none	1·47	none	·3460	·0006	·0008	·0040	·0080	7·0°	4·0°	10·64	traces mineral	S. Harvey.
Croydon	f. green	earthy	1·12	traces	traces	·0100	·0110	none	·0300	15·0°	8·0°	23·80	none	C. Heisch.
Derby	v. good	none	·99	none	·1100	·0031	·0131	·0080	·0420	10·3°	3·8°	21·00	trace veg. matter	Wigner & Harland.
Exeter	f. yellow	none	·84	traces	·2300	·0007	·0045	none	·0343	2·8°	2·8°	7·00	none	F. P. Perkins.
Grantham	greenish blue	none	1·12	traces	·7220	·0010	·0025	none	·0140	16·7°	5·5°	23·13	none	A. Ashby.
Huddersfield ..	brownish yellow	rain w.	·50	traces	·0080	·0070	·0060	·0020	·0195	2·1°	1·5°	4·60	none	G. Jarmain.
Hull	good	none	1·30	traces	·4100	·0005	·0021	·0015	·0050	16·0°	3·5°	22·80	none	J. Baynes.
King's Lynn ..	milky opaque	slight	1·55	h. traces	·3260	·0538	·0028	·0300	·0630	16·1°	5·3°	28·75	Amorphous organic matter	W. Johnstone.
Leamington ..	greenish	none	1·40	none	none	·0014	·0035	·0040	·0140	28·4°	17·5°	30·80	none	A. B. Hill.
Leeds	light brown	peaty	·62	traces	none	·0003	·0030	·0200	·1100	5·2°	2·9°	6·44	sand, peaty matter	T. Fairley.
Manchester....	slightly turbid	peaty	·75	traces	none	·0025	·0040	·0053	·0516	1·9°	1·7°	4·75	none	W. Thomson.
Newcastle-on-Tyne......	f. yellow	none	·88	traces	·0600	·0010	·0090	·0140	·0700	16·6°	5·0°	21·30	none	J. Pattinson.
Norwich	peaty	none	1·90	traces	traces	traces	·0072	·0100	·0680	17·0°	4·5°	22·80	none	W. G. Crook.
Oldham, Piethorn	dirty yellow opaque	slight	·71	v. h. traces	·0800	·0087	·0032	·0060	·0820	2·7°	2·0°	5·40	vegetable debris	Wigner & Harland.
Do. Strinesdale	yellowish opaque	slight	·71	v. h. traces	·1100	·0025	·0027	·0040	·0700	5·7°	5·0°	10·00	animal and vegetable debris	Wigner & Harland.
Salford	c. yellow	slight	·50	none	none	·0005	·0030	none	·0250	3·5°	3·0°	4·00	none	J. C. Bell.
Sevenoaks	colourless	none	1·22	traces	·2660	·0060	·0010	·0010	·0330	13·1°	3·8°	19·88	none	B. Dyer.
Sheffield	brownish turbid	none	·50	none	none	·0021	·0049	none	·0970	4·0°	4·0°	5·81	none	A. H. Allen.
Shrewsbury ..	colourless	none	1·26		·3700	·0020	·0040	none	·0070	22·8°	5·0°	27·60	none	T. B. Blunt.
Sunderland....	pale blue	slight	1·99	traces	·2500	·0017	·0028	·0060	none	9·7°	3·8°	25·80	vegetable matter	Wigner & Harland.
Warwick	greenish yellow	slight	1·19	traces	·1540	·0028	·0049	·0080	·0530	21·0°	17·2°	21·00	none	A. B. Hill.

ON THE IDENTIFICATION OF THE COAL-TAR COLOURS.*

By John Spiller, F.C.S.

Dyers and others who are in the habit of using the coal-tar colours are familiar with a number of chemical reactions by which the members of the series may generally be classified and identified. Differences are remarked in their relative affinities for various sorts of fibres, some colours being taken up freely by silk, others fixing better upon wool, and some few, like saffranin, exhibiting a special affinity for cotton. Again, as with the yellows, great differences are observed when the operator proceeds to work with a free acid or a weak alkali in the dye-bath. Primrose (naphthaline yellow) requiring the former, but not so with phosphorine (crysaniline yellow), which demands a neutral or even slightly alkaline bath.

By the study of these conditions, aided by a few characteristic tests, it is often possible to identify colouring matters of unknown or doubtful origin, and it is with the view of extending the number of such readily available tests that I recommend a more frequent appeal to the colour reactions with sulphuric acid.

For this purpose but small quantities of material are required, a few grains serving to impart a distinct colour to a comparatively large bulk of sulphuric acid, and the resulting indications are in many cases both specific and permanent. Oil of vitriol, which so readily destroys nearly all organic structures, does not carbonise any of the coal-tar colours, or does so only under severe conditions, as at high degrees of heat. Even indigo and madder, although of true vegetable origin, are known to yield up their colouring-matters to sulphuric acid, the old process of dyeing depending upon this fact. In the manufacture of garancine from madder the woody fibre and organised tissues are destroyed by the action of sulphuric acid, whilst the alizarin glucoside survives, and with it Turkey-red goods may be dyed.† Instances might be multiplied as proof that colouring-matters, both natural and artificial, resist the attack of oil of vitriol, and the large class of sulphonates (Nicholson blues, "acid roseine," &c.) may be cited as establishing the fact that colouring-matters are not so destroyed, but form combinations with sulphuric acid.

If, then, the body under examination be dissolved in strong oil of vitriol, a colour-test is at hand whereby useful inferences may be derived as to the nature of the dye, and often its exact identity disclosed. A few direct confirmatory tests may then be applied. The most remarkable colour reactions are the following:—

Magdala (napthaline pink).........	Blue-black.
Saffranin..............................	Grass-green, becoming indigo-blue on strongly heating.
Crysödin..............................	Deep orange, turning almost to scarlet on heating.
Alizarin	Ruby-red or maroon.
Eosin	Golden yellow.
Primrose (napthaline yellow)......	Difficultly soluble, first yellow, and colour discharged on heating.
Crysaniline	Yellow or brown solution, of marked fluorescent character.
Aurin	Yellowish brown, non-fluorescent.
Atlas orange	Rose colour, turning to scarlet on heating.
Atlas scarlet	Scarlet solution, very permanent on heating.

* Read before the Chemical Section of the British Association, Swansea Meeting.

† See W. H. Perkin's "*History of Alizarin*," *Journ. Society of Arts*, May, 1879.

Biebrich scarlet, R.	Blue-black or deep purple.
" " B.	Bluish green.
Aniline scarlet	Golden yellow, permanent on heating.
Indulin	Slatey blue to indigo, according to shade of the dye.
Rosaniline, regina, and all violets	Yellow or brownish yellow.
Phenyl and diphenylamine blues	Dark brown solutions.
Iodine green........................ Malachite green	Bright yellow solutions, the former giving off iodine on heating.
Citronine	Pale cinnamon or neutral tint.

After vitriol the action of concentrated hydrochloric acid may be next tried, which distinguishes at once between saffranin and Biebrich scarlet, the former giving a violet solution and the latter being precipitated as a red flocculent powder.

Proceeding in this way, and combining the observation with the dyer's usual test, every one of the substances named can be readily identified, and much time saved in the examination of dye-stuffs.

ADULTERATION IN AMERICA.

In continuation of the Abstracts of Essays in our last number we now give one or two others.

The third prize essay is by Dr. W. H. Newell, and the only clauses at all interesting to English analysts are those which are embodied in the proposed Laws as definitions of offences, and the following which relate to the appointment of Boards of Health and Analysts.

STATE LAW BY "OVERCOME EVIL WITH GOOD."

An Act, entitled, an Act to regulate the manufacture and sale of food, and the adulteration of the same.
Be it enacted by the Senate and General Assembly of the State of—

That the Governor shall appoint seven persons, who together with the Secretary of State and Attorney General, as ex-officio members, shall constitute the Board of Health of State of—

The persons so appointed shall hold their offices for seven years.

Provided; that the terms of office of the seven first appointed shall be so arranged that the term of one shall expire each year, and the vacancies as created as well as all vacancies occurring otherwise shall be filled by the Governor.

They shall appoint a chairman, who shall call meetings as often as every............months or when requested to do so by any three members of the board; they shall in the month of............ make report to the Governor of their investigations and opinions during the year ending............ with such suggestions as they may deem necessary.

The board shall elect a secretary from their own number, who shall superintend the work prescribed in the law, as the board may require.

Every city or borough or incorporated town, or any town governed by a commission, shall have a board of health, of not less than five, or more than seven members; of which the keeper or recorder of vital statistics, and also one city physician, and city health inspector, shall be members, if there be such officer or officers; and the said board of health shall be nominated by the mayor, and approved by the common council or other governing board of the city, borough or town, to serve for not less than three years, but not more than three of the number shall go out of office at one time, unless in case of removal by death or change of residence.

In such township of State outside of city limits, the township committee, together with the assessor, and the township physician, if there be such an officer, shall constitute the Board of Health for all of said township outside of city limits; and shall have the same powers as are possessed by any city board of health, within the State, so far as this could relate to any unincorporated district.

Every local Board of Health of any city, borough, town or township, shall on or before the first of

each year, in addition to any other report that the local authorities may require, prepare an annual report, concerning the adulteration of food in their district, and shall therein answer any enquiries which have been addressed to them by the State Board of Health: in the case of cities the same shall be presented to the city authorities; and the Board of Health shall on or before the fifteenth of the above month of each year, forward a copy of the same to the address of the State Board of Health.

For the purpose of fulfilling the requirements of this Act, the State Board of Health may aid any local board to the amount of............dollars in any one year; and also for the purpose of fulfilling the requirements of this Act, the State Board of Health be authorised to expend............dollars each year; said expenditure to be accounted for each year, by itemized bills, audited by the president and secretary of the State Board of Health, and approved by the Governor.

In case of any county having a county board of health nothing in this bill shall change or modify their former power or jurisdiction, and they shall possess all the authority herein granted to city or township boards: and they shall yearly report to State Board of Health in the same way, as is required in counties where there is no county board of Health; nothing in this Act shall relate to or effect any city board of health now organised in any of the cities of this State, under the provisions of their respective charters.

The State Board of Health and all boards of health appointed in the different counties of this State, shall take cognizance of the interests of the public health as it relates to the manufacture and sale of food and the adulteration of the same; they shall make all necessary investigations and inquiries relating thereto, and fulfil all the provisions of this Act.

The clauses defining offences are as follows, and, as will be seen, are almost identical with the English Acts :—

First—For the purpose of this law the term "food" shall include every article used for the food and drink, or in the food and drink of man and animals.

Second—The standard by which the offence of adulteration shall be judged, or the degree in which the offence may have been committed, shall be:

For simple articles of food, a fair average quality of the substances in their natural condition, or as best prepared by drying, grinding, packing, etc., without damage from their natural condition.

For compound articles of food—the publicly known formulas or patents, whereupon they should be compounded; or the labels, or descriptions, attached to the compounds as given, sold, offered, or held in possession.

In the case of proprietary or proprietary private compounds, the constituents of which are legally held as secrets, the testimony of the owners of the private formulas shall be accepted as evidence of the character of the compound.

Provided, That nothing herein contained, shall be construed so as to protect or permit the issue of any compound, which contains any poisonous or hurtful ingredients, not publicly stated and professed by the label, attached to the compound when given, sold, offered, or held in possession.

Third—For the purposes of this law, the offence of adulteration shall be as follows: The adding of one or more substances to another, or others, whereby the strength, purity, quality, or true value of the resulting substance or mixture, is reduced or lowered in its nature or composition, with the effect of tending to deceive the public by lowering such substance or mixture from its original and true value, or allowing the public significance and common meaning of the name by which it was or is originally known or used.—(Examples: corn meal in flour; chicory, &c., in coffee; terra alba in cream tartar).

The substitution of one substance for another, either wholly or in part, with the effect of tending to deceive or mislead the public, or any part of them.—(Examples: artificial wines, liquors and mixtures, artificial mustard).

The abstraction of any substance, with the effect that the separation shall reduce the value of the substance, and thus tend to deceive or mislead by changing the common significance of the name, by which as a whole the substance was originally applied to use.—(Cream from milk, partly exhausted coffee and tea).

The application of a name commonly known or understood to indicate any substance, to any part or parts thereof, or to any other substance, with the effect of tending to deceive and mislead.—(Oleomargarine for butter, potato starch for arrowroot).

The admixture of different qualities of the same substance, with the effect of tending to deception and fraud.—(Canned provisions, damaged wheat in flour.)

Any debasement or dilution of any substance, whereby it is reduced in intrinsic value and is yet liable to be given, bought, sold or used as though it were not debased or diluted.—(Examples, diluted milk and vinegar).

Any mixing, colouring, staining, coating, polishing, or powdering, or any other alteration in the physical condition or sensible properties of any substance, with or without addition to or substraction from it, whereby damage is concealed, or it is made to appear better or greater than it really is, either in quality, weight, or measure, or whereby impurities or defective quality are partially or wholly masked or hidden with the effect of tending to deceive or mislead.—(Colouring or polishing of green coffee, bread from damaged or mixed flour, large bread of short weight).

The giving, or selling, or offering for sale, or the possession of any adulterated article by any person whose business it is to make or to deal in articles of food, shall be *prima facie* evidence of the offence of adulteration.

PROVIDED, That it be and it is hereby declared to be the sole and entire object and intention of this law to protect the public against deception and fraud in the cost and quality of food through adulteration, and all the provisions of this law shall be construed and applied in accordance with its sole object, by the rules of common law.

No person shall adulterate nor cause nor permit any other person to adulterate any article of food, under a penalty in each case not exceeding..................dollars fine for first offence. But every offence after a conviction for a first offence shall be a misdemeanor, for which, on conviction, the person shall be imprisoned with hard labour for a period not exceeding..................and fined not exceeding................dollars.

No person shall give, or sell, or offer for sale, or hold, under the ordinary conditions of saleable commodities, any adulterated articles of food, under the same penalties as in the preceding section.

No person shall give, or sell, or offer for sale, or hold, under the ordinary conditions of saleable articles, any food which may have become through natural or accidental causes, deteriorated, or adulterated, so as to be unfit for common use, under the same penalties as in the preceding section.

The essay by Dr. O. Wight, which is recommended for printing, embodies a draft bill, the principal clauses of which are as follows:

A BILL TO PREVENT THE ADULTERATION OF FOOD AND DRINK.

The People of the State of................represented in Senate and Assembly, do enact as follows:

SECTION 1. Every person who, within the limits of this State, shall knowingly sell or give away, or knowingly cause to be sold or given away, or knowingly manufacture any poisonously adulterated food or drink of man, from the effects of which food or drink any other person dies, either within or without the State, shall be deemed guilty of manslaughter, and shall be punished by imprisonment, either with or without hard labour, not more than twenty years.

SECTION 2. Every person who, within the limits of this State, shall knowingly sell or give away, or knowingly cause to be sold or given away, or knowingly offer to sell or give away, or knowingly manufacture, or knowingly transport or receive, any poisonously adulterated food or drink of man, from the use of which food or drink any other person might die, shall be deemed guilty of an attempt to commit the crime of manslaughter, and shall be punished by imprisonment, with or without hard labor, not more than three years, and by a fine of not more than one thousand dollars.

SECTION 3. Every person, who, within the limits of this State, shall knowingly sell or give away, or knowingly cause to be sold or given away, or knowingly manufacture, any adulterated food or drink of man, from the use of which food or drink any other person receives serious injury to health, shall be deemed guilty of a misdemeanor and shall be punished with imprisonment, with or without hard labour, not more than two years, or by a fine of not more than one thousand dollars.

SECTION 4. Every person who, within the limits of this State, shall knowingly sell or give away, or knowingly cause to be sold or given away, or knowingly offer to sell or give away, or knowingly manufacture, or knowingly transport or receive, any adulterated food or drink of man, from the use of which food or drink any other person receives serious injury to health, shall be deemed guilty of a misdemeanor and shall be punished by imprisonment, either with or without hard labour, not more than one year, or by a fine of not more than five hundred dollars.

SECTION 5. Every person who, within the jurisdiction of this State, shall knowingly sell or give away, or knowingly cause to be sold or given away, or knowingly offer to sell or give away, or knowingly manufacture, or knowingly transport or receive, any food or drink of man, which food or drink contains *any additional* substance, beyond what may be necessary for its collection, manufacture or preservation,

that sensibly increases its weight, bulk or strength, or gives it a fictitious value; or from which any important constituent has been wholly or in part abstracted or omitted; or which is an imitation of, or under the name of another article; unless such necessary additional substances, or such abstracted or omitted constituent, or such imitation or change of name be acknowledged and declared at the time of sale or transportation, and be clearly stated in all invoices and bills of sale thereof, and be announced in writing or print on a label firmly and durably attached to any package or parcel of whatsoever kind or nature, containing such food or drink; shall be deemed guilty of a misdemeanor and shall be punished by a fine not exceeding three thousand dollars.

SECTION 6. Every article of food or drink of man found within the jurisdiction of this State, which article contains any ingredient rendering the same dangerous to the life or injurious to the health of a consumer thereof, shall be liable to seizure and condemnation, and when seized and condemned shall be deemed contraband of commerce and destroyed.

SECTION 7. Every article of food or drink of man, found within the jurisdiction of this State, which article contains any unnecessary substances giving the same a ficitious value, or from which any important constituent has been wholly or in part abstracted or omitted, or which is an imitation and under the name of another article, shall, unless said article bears a label as provided in chapter Five of this Act, be liable to seizure and condemnation, and when seized and condemned shall be forfeited to the lawful use of the State.

REVIEW.

Spon's Encyclopædia of the Industrial Arts, Manufactures and Commercial Products.

Edited by CHARLES G. WARNFORD LOCK. London: E. & F. N. Spon, 16, Charing Cross.

The third division of this excellent work has now been published, bringing down the subjects to the letter I. The present volume contains *inter alia* Cotton, Drugs, Dyeing and Dyestuffs, Electro-metallurgy, Explosives, Fibrous Substances, Floorcloth, Food Preservation, Fruit, Fur, Gas, Gems, Glass, Hair, Hats, Honey, Hops, Horn, Ice Making, and Indiarubber. Where all the articles are so excellent, it may appear invidious to select any for special commendation, but there are two which will be found specially interesting. The first is that on Electro-metallurgy, which has received an immense *impetus* through the introduction of nickel plating and the use of magneto-electric machines instead of batteries. The whole subject is very practically treated, but perhaps a few critical remarks about the merits of the various machines, and more especially that excellent one recently introduced by Mr. Elmore, which has been received with so much favour by practical men, would not have been out of place, as after all much depends on the continuity and easy running of the generator. The second article is that on Floorcloth, in which for the first time, so far as we know, the nature and manufacture of the article Linoleum is fully discussed. The author, in whose initials we recognise Mr. W. F. Reid, goes into the matter not only in the practical, but also in the scientific manner to be expected from a gentleman of his chemical training. He gives an interesting account of the solid substance obtained by the oxidation of linseed oil, and mentions that he finds the sulphuric acid test only to give approximate results in the determination of the quality of the oil. He employs a practical test, which is as follows: He heats the oil in an iron vessel with half per cent. of finely ground litharge, and the same of red lead, to a temperature of 260° C (500° F.), blowing at the same time air through the liquid. So soon as a little of the oil cooled on an iron plate appears "stringy," the heat is removed, and the whole stirred till cold. If the oil be genuine a perfectly solid substance results, but, if adulterated, it is more or less liquid according to the quantity of non-drying oil it contains. The article on Fibrous Substances is also very complete; and, in a word, the whole keeps up the excellent promise of the first volume.

CORRESPONDENCE.

[The Editors are not responsible for the opinions of their Correspondents.]

LARD ADULTERATION.

To the Editor of "The Analyst."

Sir,—Replying to Mr. Percy Smith's letter in your last number, allows me to say that a very large number of samples of lard have been examined by the Public Analysts in this part of the country, myself among the number, and scarcely a single adulterated sample has been found.

The only adulterant ever known, or at any rate found to be used, is water, which is occasionally introduced to the extent of some 10 or 15 per cent. This fraud is, however, very rare now.

The difference between the melting points of the different samples of lard which Mr. Smith tried, is mainly due, in all probability, to their containing different proportions of the oleine, which is a natural constituent of pig's fat, but is often pressed out from it and sold separately as a lubricating oil, under the name of lard oil. This treatment raises the melting point because lard oil has a lower melting point by many degrees than lard itself. The treatment also improves the lard and renders it more suitable for cooking purposes.

I am, Sir,

January 13th, 1881. AN INTERESTED ANALYST.

ANALYSTS' REPORTS.

At the Wiltshire Quarter Sessions, the report of the County Analyst, which was presented, stated that during the quarter analyses of salt butter, sugar, and coffee had been made. The salt butter was found to be adulterated with excessive water, but the samples of sugar and coffee were proved to be genuine.

At Somerset Quarter Sessions on Tuesday, the report of Dr. H. J. Alford, the recently appointed County Analyst, was presented. He stated that during the quarter he had not received any samples for analysis from the general public, but 314 from the inspectors, this number being largely in excess of former reports. The adulteration discovered was not such as was prejudicial to health. Butter was fairly good, except salt butter ; chicory was mixed with coffee to a considerable extent, and the cocoa contained very little cocoa, but a good deal of starch. The reading of the analyst's comments excited much laughter among the magistrates, who used to have mere formal documents from the former analyst, Mr. W. W. Stoddart.

Mr. F. M. Rimmington, Analyst for Bradford, in his report for the quarter ending December 31st, states that—"Fourteen samples of milk have been submitted to me for analysis. These were all genuine, and of excellent quality; two samples of artificial butter, or butterine so called, and three samples of confectionery. Four samples of pepper have also been analysed, and found unadulterated. After a period of nearly six years, during which the Act has been in operation in the borough, it is reasonable to review the past, and see what has been gained. The samples of milk analysed during the past quarter are the best as regards quality that I have had since the commencement. Formerly we could not obtain milk which yielded more than 4 to 5 per cent. of cream, or 2 to 2½ per cent. of butter. Latterly the yield of these constituents has been from 7 to 10 per cent. of cream, and 3 to 4 per cent. of butter. I think, therefore, the borough may be congratulated upon having obtained a supply of good milk. About two years ago a good deal of attention was paid to the butter supply, and much of that which was sold was found to contain 4 or 5 per cent. of salt, which was said to be quite necessary for its preservation, and 20 to 25 per cent. of water, and some prosecutions were instituted. Judging from those samples brought to me during the past few months, the proportions of water have been reduced to 11 or 12 per cent., and the salt to 1 or 2 per cent. At the commencement of the Adulteration Act, proceedings for adulterated pepper and some other articles of this class were numerous, but for the last two or three years there has not been an instance of this kind of sophistication. On the subject of butterine perhaps I may be allowed to make some remarks. This artificial butter, when honestly made, is a preparation of beef suet, and so long as it is sold for what it is, nothing can be said against it on the score of wholesomeness—but assuming it to attain a more general use than it now has, the question suggests itself—What guarantee is there that it will always be obtained from sound and healthy beasts, and not from fat procured from other animals not usually killed in a slaughter-house. It is very *doubtful* whether the greatest vigilance would be sufficient to ensure the public from imposition and

perhaps danger in this way. The subject is an important one. On the one hand a fat which is mainly used for making soap and candles is converted into a useful and economical article of diet; and on the other hand there is the possibility of nasty and unwholesome substances being foisted on the public under an alluring title. The subject has another phase of interest in relation to the public. The name "butterine" has been fixed upon for this substance. This term at once suggests that the article is a compound or preparation of butter. But this suggestion is a false one, as no butter enters into its composition. It is in this alluring idea, and the ease with which the terminal syllable can be dropped, that make it so easy to practice imposition, and sell it at a price double its real value."

"Previous Sewage Contamination," as defined in the *Brewers' Guardian*.—This expression repeatedly occurs in analytical reports on water, and, judging from several inquiries which have reached us, its meaning is but imperfectly understood. When a water percolates from the surface to some depth in a well it passes through a series of strata, each of which gives up some soluble constituents. Near the surface there is often an accumulation of animal and vegetable matters in a state of decay, which yield a considerable quantity of soluble nitrogenous matter, and even living organisms, to the water. Thus, shallow wells and rivers are not suitable sources of water supply, unless some efficient means of purification are adopted. When the water has to percolate into a deep well, even if it becomes charged at the surface with much organic impurity, it is gradually purified; the nitrogenous constituents undergo oxidation in passing through certain strata, and are thus gradually converted into nitrates. Should any organic matters either escape oxidation or percolate direct into the well, they will gradually exert a reducing action, and by taking away oxygen again from the nitrates, convert these salts into nitrites. Thus both nitrates and nitrites are produced from organic matters, and the determination of the quantity of nitrogen existing in the water in the form of these salts, gives us the "previous sewage contamination" or the oxidised nitrogenous impurities which at one time were present in the water. The presence of nitrates in a well water must therefore be considered a suspicious circumstance; although not hurtful in themselves, they are undoubted evidence of the existence of organic impurities at some stage of the water's progress, and it is possible that the oxidising action may not always be complete, and thus unconverted and previous nitrogenous matters may find their way into the well. Nitrites are even more dangerous, for, as a rule, they are the result of the action of organic matters on already-formed nitrates, and tend to show that these organic matters have either not been completely oxidised, or have found their way into the well direct.

Chicago.—At a recent meeting of produce dealers in this city, steps were taken and money subscribed towards looking to the prosecution of the dealers in adulterated goods. A committee was appointed to urge the prosecution of parties selling adulterated products as genuine. It is stated that there are fifteen factories in this city alone engaged in manufacturing so-called butter made from tallow, and latterly even from lard, and throwing it upon the market. This compound is called "butterine" or "suine," is made up in four grades, the best being 50 per cent. creamery butter and the other 50 per cent. an equal mixture of lard and beef tallow. As respects the fourth grade, its mysteries are unfathomable. Cheese is similarly adulterated, with the addition besides of soap-stone, caustic soda, and caustic potash. It is stated that these ingredients are at times so strong as to eat through the very staves of the barrels containing the article. Of course, the makers of such stuffs as these claim that they are not injurious. But such a claim must necessarily be false, and indeed is but feebly put forth. But this is not the point. Whether they are injurious or not, no party or firm should be allowed to sell any product which is not that which it purports to be. Nobody ought to be imposed on by persons selling under the broad ægis of mercantile honour, fictitious, deleterious, and even poisonous substances. It is contrary to public morals and public policy. As a matter of public policy, the manufacture of such substances and their sale as genuine, no matter how low the prices, must most assuredly drive good, healthy and pure articles out of the market. Not only so, but it will so injure the good name of the city and country as to cast suspicion upon their every product.—*Chicago Journal of Commerce.*

A patent for the manufacture of oleomargarine has just been published. Beef suet is melted in water, to which are added salt, carbonate of potash, chlorate of potash, and nitrate of soda. The fat is then conveyed to a separate vessel and fine salt added, the whole being agitated and allowed to cool, after which it is pressed.—*Grocer.*

LAW REPORTS.

Workhouse Milk in London.—Heavy Fines for Adulteration:—

Collison Hall, jun., of the Short Horn Dairy Company, 21 and 23, White Lion Street, Bishopsgate, was summoned before Mr. Lushington, at the Thames Police Court, for delivering to St. George's-in-the-East Workhouse, to the prejudice of the purchaser, a quantity of adulterated milk. There was another summons for supplying adulterated milk to St. George's-in-the-East Infirmary. Mr. Hannay, solicitor, defended, and pleaded guilty on behalf of his client, but urged in mitigation of punishment that the defendant had carried on business for more than forty years, and this was the first complaint against him that the milk he sold was adulterated. The milk referred to never came to the defendant's premises, but was taken direct from a railway station, where it arrived from the country, to St. George's-in-the-East Workhouse. It must have been tampered with at the station or in transit, as the carman who had been in charge of the milk absconded and left his horse and vehicle in the road. The defendant had exercised all the vigilance human ingenuity could do, and he had the foreman in court to prove what he had asserted. It was the custom at public institutions to test the milk before it was sent in, and then to inform the vendor whether it was adulterated or not, which ought to have been done in this instance. In answer to Mr. Lushington, William Rains, sanitary inspector of St. George's parish, said he took one sample of milk from the workhouse which was adulterated with 20 per cent. of water, and the other from the infirmary containing 20 per cent. of water. The afternoon delivery at the workhouse was 45 quarts, and rather more in the infirmary. He was not aware that the milk supplied by the defendant had been tested before. Mr. Lushington said the defendant pleaded guilty to both summonses, for supplying the infirmary and workhouse of St. George's with adulterated milk, and had entered into a contract to serve a very large quantity of unadulterated milk. He was bound to take sufficient steps to ascertain that the milk supplied by his servants was not adulterated, and it was not a case in which he could listen to anything like the infliction of a nominal penalty. He fined the defendant £10 on each summons.

Workhouse Milk in Dublin:—

In the Southern Divisional Police Court, Dublin, James Greunan, dairyman, has appeared at the suit of the Guardians of the South Dublin Union, who alleged that he sold and delivered milk at the Workhouse which was adulterated with 20 per cent. of water. It appeared that defendant was one of the contractors for the supply of milk to the Workhouse, and Alexander Frazer, storekeeper in the Workhouse, demanded one gallon of the forty-five gallons of milk that was being delivered one morning at the Union. This he had analysed by Dr. Cameron, who certified to 20 per cent. of added water. For the defence it was stated that the contract had been, from the beginning, executed by a dairykeeper named Collins, who had failed in getting the contract from the Guardians. Collins received all the moneys paid by the Guardians. It was also urged that inasmuch as Frazer did not pay for the milk, he had not complied with the Act of Parliament. The Magistrate held that the Act had been complied with, and fined the defendant £10, with two guineas costs, and refused to state a case.

Conviction for Refusing to Serve Inspector:—

William Kennarbey, of Putney, was summoned at the same time and place for refusing to sell milk to the inspector in a street for the purpose of being analysed. The defendant set up a defence that the inspector could only demand to be supplied at the shop. Mr. Shiel said the defendant was wrong in his law. The inspector then proved that the defendant had been fined 30s. for selling adulterated milk. Mr. Shiel now fined him 40s. and 2s. costs.

Summons for Selling "Prepared" Coffee:—

Peter Bratt, grocer and Italian warehouseman, who has numerous establishments in the city and borough, was summoned at the Salford Borough Police Court, on Thursday, before Mr. J. Mackinson the Stipendiary Justice of the Borough, by the Corporation under the Sale of Food and Drugs Act, 1875, for selling to the prejudice of the purchaser a tin of coffee known as "Franck's Prize Medal Coffee," which, it was alleged, was not of the nature, substance, and quality of the article demanded. Mr. J. C. Walker, Assistant Town Clerk of Salford, appeared in support of the summons, and Mr. Edge, barrister-at-law, appeared for the defendant. The case had been taken up by the Manchester and Salford Grocers' Association. Mr. Walker, in opening the case, said that on December 13th, Mr. Thompstone, the inspector for the borough, called at the defendant's shop, 189, Broad Street, Pendleton.

Mr. Bratt there carried on business under the style or firm of Bratt and Hobson. The inspector asked one of the defendant's shopmen for a quantity of coffee known as Say's coffee. The shopman said they did not keep Say's, but they had Franck's coffee and showed him a half-pound tin and recommended it. The inspector said he would take the half-pound tin, and paid 10d. for it, which was at the rate of 1s. 8d. per lb. This he (Mr. Walker) contended was a fair marketable price for good coffee. He should call witnesses who would tell the Court that coffee ranged from 1s. 6d. to 2s. per lb. Nothing was said by the shopman until after the purchase was completed as to the coffee being a mixture of coffee and something else. Mr. Edge here interposed, and said Mr. Walker had better read the label on the tin of coffee sold to the inspector—a label which was on the tins of Franck's coffee. Mr. Walker said he was coming to that point presently. The label went on to say a lot of praiseworthy things about this Franck's coffee, and on the one side in very small type it said: "Purchasers must ask for Franck's coffee which is sold as an admixture, and are particularly requested to see that every tin bears this label." The inspector was not told that this was anything but coffee, and he (Mr. Walker) contended that the words "sold as an admixture" were not sufficiently distinct. According to the 8th Section of the Act the notice that the article was an admixture must be "distinctly and legibly written or printed," and the notice on Franck's label was not printed sufficiently legible. His (Mr. Walker's) second point was that on the authority of the case Liddiard *v.* Reece, which was before the Court of Queen's Bench on November 28th, 1879, and reported in the *Justice of the Peace* of April 10th, a label of this kind was no protection to the seller, if the chicory, or whatever it might be, had been added for the purpose of fraudulently increasing the bulk of the article sold. Liddiard *v.* Reece was a case almost similar to the present one. An inspector went into a shop and asked for half a pound of coffee, for which he paid 9d. He took it for analysis, and after being told this the shopman pointed to the label on the wrapper, showing that it was a mixture of chicory and coffee. On analysis that coffee was found to contain 40 per cent. of chicory, and Mr. Justice Lush said, "I think here the case finds that the coffee was fraudulently mixed with intent to increase the bulk. If so, I cannot see how the label protects the seller." The fine imposed on the shopkeeper in that case was upheld, and Mr. Justice Lush said the conviction could not be interfered with. The Stipendiary: But in that case coffee was asked for. Did the inspector in this case ask for coffee? Mr. Walker: Yes; this tin was put before him as Franck's coffee. The fact of the words "Franck's coffee" does not make it of any more value, and I contend that the seller should inform the purchaser of the contents of the tin. If a person asks for Franck's coffee, he has a right to obtain coffee, and not a mixture of chicory and coffee. Mr. Walker then went on to quote another case from the same number of the *Justice of the Peace*, Hodder *v.* Meddings, in support of his contention that the ingredients must be stated on the label, and that if anything had been added to the coffee for the purpose of fraudulently increasing the bulk the seller was liable to a penalty. Mr. Mackinson: But here in the present case a specific article is sold to the inspector which is known as Franck's coffee, and which is stated to be an admixture on the label. Inspector Thompstone was then called, and stated that he visited Mr. Bratt's shop in Pendleton on December 13th. There were two assistants in the shop, named Percival and Scholes. Witness asked Percival for half a pound of Say's coffee. He said, "We have not got Say's; but we keep Franck's prize medal coffee, and have half-pound tins." Percival produced a half-pound tin, and he (witness) said "I will take this coffee," mentioning the word "coffee" again. The coffee was in the tin produced, and he paid 10d. for it, which was at the rate of 1s. 8d. per lb. Mr. Walker: Are you able to say that 10d. is a fair market price for coffee? —Yes; it is. Not mixture?—No. Nothing was said to me about its being anything but coffee until I had paid for it and said I wanted it for the purpose of being analysed. I noticed there was no mention of chicory on the tin. I divided the coffee into three parts in the usual way, and submitted a portion to the Borough Analyst, whose certificate states that it contained 20 per cent. of chicory. Chicory can be bought at 4d. and 5d. per lb. retail. Mr. Mackinson (the Stipendiary), without calling upon Mr. Edge for his defence, said the summons must be dismissed. In the first place, he did not believe that the chicory had been added for the purpose of fraudulently increasing the bulk; and, further, when the inspector asked for Say's coffee, he was told they had not got any, and was shown a tin of Franck's prize medal coffee, and he said "I'll take it." This Franck's coffee was put up in tins and sold as "prepared" coffee, the label on each tin stating that it was an admixture; and this was put before the inspector, and he said "I'll take this." The fact of his saying, "I'll take this coffee," particularly mentioning the word "coffee," did not, in his (Mr. Mackinson's) opinion, affect the case. There was not, to his mind, the slightest intention to defraud by the seller, and the summons would be dismissed. Mr. Walker said, in case the Corporation thought it desirable, would the magistrate grant a case for decision in a higher court. Mr. Mackinson intimated his willingness to do so.

Butterine Prosecutions.—Heavy Fines :—

At Worship Street Police Court, Mr. Alfred John Palmer, of 281, Roman Road, Old Ford, and Mr. James Summer, of 240, Roman Road, Old Ford, buttermen and cheesemongers, appeared to summonses taken out by the sanitary authorities of the parish of St. Mary, Stratford, for selling as butter an article not of the nature and quality demanded. Mr. Summer, whose defence was that the public knew they could not have butter at 1s. 2d. per lb., and that he was not at the shop himself, said he should appeal. Mr. Hannay inflicted a fine of £20 on Mr. Summer, and on Mr. Palmer one of £5, also ordering each defendant to pay 23s. costs.

Selling Chicory and Coffee without a Label.—Conviction :—

William Morley, provision dealer, of Higher Hillgate, Stockport, was charged before the magistrates in that town, with selling adulterated coffee. Mr. Thompson (from the office of the Town Clerk) prosecuted. It appeared that Mr. Jacob Marshall, one of the borough sanitary officers, purchased at the defendant's shop half a pound of ground coffee, for which he paid 7d., the article being supplied by the defendant's wife. The certificate of the Public Analyst showed that the sample contained 52·4 per cent. of chicory. Defendant said he had only recently begun in business, and both himself and his wife were ignorant in these matters. He bought most of the mixture just as it was—certainly he mixed a little himself, and was not aware that he was obliged to put a label on it. They sold it at 1s. 2d. per lb., which, as the Bench would be aware, was not enough for pure coffee. The presiding magistrate, Mr. W. Rayner, M.D., observed that it was a great fraud upon the public to sell an article of food like that—more than one-half chicory. Defendant was fined 40s. and costs.

Butterine Prosecutions at Liverpool :—

At the Liverpool Police Court, on Wednesday, before Mr. Raffles, stipendiary magistrate, James Burke, provision dealer, 40, Everton Road, was summoned for an offence against the Sale of Food Act, by having sold butterine as butter. Evidence was given by a person who visited defendant's shop and asked for a pound of shilling butter, which he received and paid for. A sample of the article was sent to Dr. Campbell Brown, City Analyst, whose certificate, which was put in, showed that it was butterine. The defendant said the article sold was labelled butterine, but the magistrate held that this was not sufficient, and inflicted a fine of 20s. and costs.—Henry Anderton, provision dealer, 26, St. James's Street, was convicted of a similar offence, and was fined in the same amount.

Important Case under the New Act :—

At Clerkenwell Police Court, on January 13th, George Locker, of Eggerton, near Burton-on-Trent, was summoned for having, on the 15th of December last, consigned a can of milk to the Dairy Supply Company, Limited, which, on analysis, was found to be adulterated with 13 per cent. of water. From the evidence of Inspector Rouch, it appeared that on the day in question he met the milk upon arrival, and took a sample from a can sent up by the defendant. This sample he handed to the analyst for the parish of St. Pancras, who certified to the above-mentioned adulteration. The defendant denied any knowledge of the addition of water, and stated that he was prevented attending to the milk personally at the time, owing to a domestic bereavement. Under the circumstances, Mr. Ricketts, who prosecutes for the Vestry of St. Pancras, said he would not press for a heavy penalty, and the Magistrate fined Locker in the mitigated penalty of £5 and £1 5s. 8d. costs.

"Simpson" Severely Punished :—

At Belper Sessions, John Simpson, of Hazlewood, farmer, was summoned by Captain Sandys for selling adulterated milk at Hazlewood, on the 22nd November. The milk was consigned to London. James Slack purchased a pint of milk, which, on being analysed, was found to contain 28 per cent. of water. Defendant pleaded guilty. The chairman said it was a very bad case, the milk containing nearly one-third water. Defendant was fined £10 and costs.

At Wandsworth, Mr. Corsellis, clerk of the Wandsworth Board of Works, attended in support of two summonses against Joseph Saunders and William Gabbett, both grocers, of Nine Elms, for selling to the inspector milk adulterated with water. In each case the sample contained 20 per cent. of water. Both defendants stated that they sold the milk as they received it. Mr. Shiel imposed a penalty of 20s. and 2s. costs in each case.

Analysis of Milk supplied to Public Buildings:—

At the Northern Divisional Police Court, Dublin, Patrick Walsh, dairykeeper, of Lower Summerhill was charged with having sold milk not of the nature and substance of the article demanded. David Toler, food and drug inspector, said that on November 17, he found Thomas Walsh delivering new milk at the Military Prison, Arbour Hill, and purchased a halfpennyworth, telling him it was for the purpose of analysis. The man wanted to know "was that a new dodge,—inspectors going to public buildings? if it were, there would be no dairymen left in Dublin." He delivered the milk to Dr. Cameron, who certified that it contained 14·3 per cent. of water. Mr. Ennis asked that the case should be dismissed, as Thomas Walsh, the seller of the milk, had not been connected in any way with the defendant. The magistrate accordingly dismissed the case.

James Dunne, of Upper Abbey Street, was also fined £3, Dr. Cameron having certified for 21 per cent. of water. It transpired that the accused had been previously fined for a similar offence; but the Law Officer of the Corporation stated that the law did not provide a penalty for previous convictions.

ADULTERATION OF SOAPS.

Consumers of soap, says a writer in the *Deutsche Industrie Zeitung*, should not neglect to inform themselves of the absence of intentional adulterations. A very old trick is to increase the weight of soap with water, but as ordinary soap soon loses this by evaporation in the air, this deception will not succeed unless the soap is sold off quickly. There are two other methods of overweighing. One consists in putting in chemicals that are adapted to hold this excess of water in the soap, so that it loses little or nothing in weight by lying. Another way is to add some mineral substances, soluble or insoluble, to increase the weight and diminish proportionally the value of the soap.

When large consumers neglect to submit their soap to an examination they may suffer considerable loss. There is soap in the market that contains 75 per cent. water, and externally cannot be distinguished from soap that contains only 12 per cent.

Gelatinous substances are most frequently used to retain the water in soap, and at the same time an excellent filling. Alumina in the hydrated form performs this service best. The author detected this substance in six samples of soap, which had over 60 per cent. water, and were sold by their manufacturers at the same price as another manufacturer sold soap with 24 per cent. Other gelatinous substances, like silica and organic substances, are used. They are easily detected by chipping up the soap and dissolving it in alcohol, in which they are insoluble, while pure soap is perfectly soluble. The undissolved residue may be filtered out and more carefully examined. Hot water will dissolve the gelatinous substances if they are organic, like gelatine or glue, leaving alumina, silica, &c., unaffected. By evaporating the aqueous solution and weighing the residue, the quantity of gelatine can be quantitatively determined. The silica and alumina can be dried, then ignited in a platinum or porcelain crucible, and weighed.

Waterglass is frequently added to soap, and, although it is not an injurious ingredient, such soap can be made cheaper, and should be sold as waterglass soap.

In some samples the author found starch, gypsum, chalk, clay, phosphate of lime (bone ash), and barytes, or blanc fixe, as the adulterants. All these can be separated by dissolving the dry soap in alcohol. The alcoholic solution may be evaporated to dryness, dried at 212° Fah., and weighed.

The author found more adulteration in the Berlin soaps than any other; but in the little city of Munster, out of 12 samples from different factories, 5 were adulterated.

The author neglects to mention the fact that impure fats in a state of incipient decomposition are often employed, perfume being added to disguise the odour.

The *Cowkeeper and Dairyman's Journal* says:—"A defendant, rejoicing in the appropriate name of Simpson, has been fined by the Belper magistrates for having too liberally diluted a large quantity of milk intended for the London market. Though the water supply of the metropolis is by no means adequate to the requirements of the population, yet it is not at all desirable that water should be sent to us in milk cans from Derbyshire. We are glad, therefore, that Mr. Simpson has to pay heavily for his attempt to do a service in this respect. The milk which he proposed to pass off upon the confiding public of the metropolis as a genuine bovine extract was proved on analysis to contain 23 per cent. of water. He had no defence to make for having thus attempted to cheat his customers, and accordingly pleaded guilty to the offence with which he was charged. Considering that the London purveyors of milk add plenty of water to it after it arrives here, the dairy farmers who send it up from the country should be all the more careful to despatch it in an unadulterated condition. We trust that other enterprising dairymen of the 'Simpson' class will take warning from the treatment he has deservedly received at the hands of the administrators of justice at Belper."

Mr. William Morgan, Ph.D., of Swansea, has been appointed Public Analyst for the town and county of Haverfordwest.

ERRATUM.—On page 7 of our last number, line four, "Proposed Draft of a National Act," should have been "*Abstract of Proposed Draft*," &c., as only the principal clauses are there set out.

RECENT CHEMICAL PATENTS.

The following specifications have been recently published, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

No. 1880	Name of Patentee.	Title of Patent.	Price.
1921	C. Humfrey	Decomposition of Certain Salts of Soda and Potash	2d.
2214	C. M. Warren	Distillation of Anthracene	4d.
2227	P. Spence	Purifying Sewage	4d.
2236	S. Cohné	Electric Lamp	2d.
2244	W. Clark	Manufacture of an Extract of Fish	2d.
2252	G. G. André	Electric Lamps	6d.
2257	S. Simmons	Preventing Alterations in Cheques	2d.
2259	C. Wigg	Manufacture of Alkalies	6d.
2417	R. S. Newall	Apparatus for Effecting Chemical Decomposition	6d.
2458	G. Best	Apparatus for Purifying and Softening Water	6d.
2497	W. R. Lake	Manufacture of Vanillin	4d.
2322	J. B. Freeman	Manufacture of Varnishes	4d.
2323	J. Storer	Effecting Oxidation, &c., by Interaction of Gases or Vapours with Liquids, &c.	6d.
2395	H. A. Dufrené	Preserving Meat	4d.

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; Journal of Applied Science; The Boston Journal of Chemistry; The Provisioner; The Practitioner; New Remedies; Proceedings of the American Chemical Society; Le Praticien; The Inventors' Record; New York Public Health; The Scientific American; Society of Arts Journal; Sanitary Engineer of New York; The Cowkeeper and Dairyman's Journal; The Chemists' Journal; Oil and Drug News; The Textile Record of America; *Sugar Cane.*

THE ANALYST.

MARCH, 1881.

SOCIETY OF PUBLIC ANALYSTS.

AN EXTRAORDINARY GENERAL MEETING was held on the 16th February last, at Burlington House, Piccadilly.

Mr. Heisch, on taking the chair for the first time as President, thanked the Members for the honour they had done him in electing him to that position, and apologized for his absence at the Annual Meeting on account of being snowed up at Croydon, and the telegraph wires being also broken he could not communicate with the Secretary.

The Requisition for the Meeting having been read, Dr. Bartlett proposed, Dr. Tripe seconded, and it was unanimously resolved that the following be an additional Rule of the Society:—"That in the event of the resignation or death of any Officer, or of the voting by ballot for the election of an Officer of the Society resulting in an equality of votes, it shall be in the power of the Council to declare the office vacant, and to fill it up for the remainder of the current year, at their first Meeting after the date of such occurrence."

An ordinary General Meeting was then held.

The minutes of the Meeting having been read, were confirmed.

Dr. Bartlett and Mr. Maxwell Lyte having been appointed Scrutineers, opened the ballot papers, and reported that the following gentlemen were duly elected Members of the Society:—Thomas Stevenson, M.D., F.C.S., F.I.C., of Guy's Hospital, Public Analyst for Bedfordshire, Surrey, &c.; Horace Swete, M.D., F.C.S., Public Analyst for Worcester, &c.; W. Douglass Hogg, M.D., F.S.P., Chemist, of Paris; P. Vieth, Ph.D., F.C.S., Analytical Chemist; H. J. Yeld, M.D., F.C.S., Public Analyst for Sunderland; W. Johnstone, F.C.S., F.I.C., Public Analyst for King's Lynn; J. J. Broadbent, F.C.S., Analytical Chemist, of Charing Cross Hospital.

Letters were read from Prof. Fresenius and Dr. Hoffman accepting the Honorary Membership of the Society, and were ordered to be entered on the minutes.

The following were proposed for election and will be balloted for at the March Meeting. As Members—W. D. Sykes, M.D., Public Analyst for Portsmouth; John Parry, Public Analyst for Penryn; Henry Liepmann, Ph.D., F.C.S., Analytical Chemist, Leadenhall Street, London. As Associates—W. Fox, Assistant to Mr. J. Baynes, of Hull, and D. A. Sutherland, Assistant to Dr. Drinkwater, of Edinburgh.

The following papers were then read:—"On a Simple and Expeditious Process for Determining Nitrates and Nitrites in Water Analysis," by M. Whitley Williams.

"On the Action of Permanganate on Potable Waters at Different Temperatures," by G. W. Wigner and R. H. Harland.

The next meeting of the Society will be held at Burlington House on Wednesday, the 16th March.

A SIMPLE AND EXPEDITIOUS PROCESS FOR THE ESTIMATION OF NITRIC ACID IN WATER ANALYSIS, WITH SOME REMARKS ON THE ESTIMATION OF NITROUS ACID.

BY M. WHITLEY WILLIAMS, F.I.C., F.C.S., formerly Chemical Assistant in the Royal Institution of Great Britain.

Read before the Society of Public Analysts on 16*th February*, 1881.

IT is well known that when zinc is immersed in copper sulphate solution it becomes covered with a spongy deposit of precipitated copper. If the solution of copper sulphate be sufficiently dilute, this deposit of copper is black in colour and firmly adherent to the zinc. It is, however, not so generally known that the zinc upon which copper has thus been deposited possesses the power of decomposing pure distilled water at the ordinary temperature, and that it is capable of effecting many other decompositions which zinc alone cannot. Among these is the decomposition of nitrates, and the transformation of the nitric acid into ammonia. Messrs. Gladstone and Tribe have shown that the action of the "copper-zinc couple" (as they call the conjoined metals) upon a nitre solution consists in the electrolysis of the nitre, resulting in the liberation of hydrogen and the formation of oxide of zinc. This hydrogen is liberated upon and occluded by the spongy copper, and when thus occluded it is capable of reducing the nitre solution in its vicinity. The nitrate is first reduced to nitrite of potassium, and the nitrous acid is subsequently transformed into ammonia by the further action of the hydrogen. In a paper lately read before the Chemical Society I have shown that even in very dilute solutions of nitre the nitric acid can be completely converted into ammonia in this manner with considerable rapidity; and I have further shown that the reaction may be greatly hastened by taking advantage of the influence of temperature, acids, and certain neutral salts which increase the electrolytic action of the couple. I there showed that carbonic acid—feeble acid as it is—suffices to treble the speed of the reaction, and that traces of sodium chloride (0·1 per cent.) accelerated it nearly as much as carbonic acid. A rise of a few degrees in temperature was also found to hasten the reaction in a very marked degree. The presence of alkalies, alkaline earths, and salts having an alkaline reaction, was found to retard the speed of the reduction.

Upon those experiments I founded a simple and expeditious process for estimating the nitric and nitrous acid in water analysis, which, when used with skill, may be applied to by far the greater number of waters with which the analyst is usually called upon to deal. Before describing this process I will first say a few words upon the nature and use of the copper-zinc couple, about which considerable misapprehension appears to exist even in the best informed quarters. This appears very plainly from the description of the copper-zinc couple process given in the *Handbook of Water Analysis*, recently published by Frankland, in which mistaken directions are given for making the couple and applying it to the estimation of nitric acid in water analysis. There are two kinds of copper-zinc, one (the "dry couple") intended for anhydrous reactions, the other (the "wet couple") intended for hydrogenizations in watery or alcoholic solutions. These two are quite different reagents, differently prepared and different in their application. It is the "wet couple" alone which is adapted to hydrogenizations, such as the transformation of nitric acid into ammonia; but in the handbook

referred to, the dry couple is described as being used for effecting this transformation, a purpose to which I believe it has never been applied, and for which it would certainly be very inefficient.

The wet couple, with which alone we have now to deal, is prepared in the following manner:—The zinc to be employed should be clean, and for the sake of convenience should be in the form of foil or very thin sheet. It should be introduced into a flask or bottle, and covered with a solution of copper sulphate, containing about 3 per cent. of the crystallized salt, which should be allowed to remain upon it until a copious firmly adherent coating of black copper has been deposited. This deposition should not be pushed too far, or the copper will be so easily detached that the couple cannot be washed without impairing its activity. When sufficient copper has been deposited the solution should be poured off, and the conjoined metals washed with distilled water. The wet couple is then ready for use.

To use this couple for the estimation of nitrates, in the manner I am about to describe, it should be made in a wide-mouthed stoppered bottle. After washing it is, of course, soaked with distilled water; to displace this, it is first washed with some of the water to be analysed, and the bottle filled up with a further quantity of the water. The stopper is then inserted, and the bottle allowed to digest in a warm place for a few hours. If the bottle be well filled and stoppered, the temperature may be raised to 30° C., or even higher, without any fear of losing ammonia. The reaction will then proceed very rapidly; but if it be desired to hasten the reaction still more, a little salt should be added (about 0·1 grm. to every 100 c.c.), or if there be any objection to this, the water may have carbonic acid passed through it for a few minutes before it is poured upon the couple. In the case of calcareous waters, the same hastening effect may be obtained, and the lime may at the same time be removed by adding a very little pure oxalic acid to the water before digesting it upon the couple. In my paper communicated to the Chemical Society I showed that nitrous acid always remained in the solution until the reaction was finished. By testing for nitrous acid the completeness of the reaction may be ascertained with certainty, and perhaps the most delicate test for nitrous acid that can be applied for this purpose is that of Peter Griess, in which metaphenylene diamine is the reagent employed. When a solution of this substance is added to a portion of the fluid, and acidified with sulphuric acid, a yellow colouration is produced in about half-an-hour if the least trace of a nitrite be present. The reaction easily detects one part of nitrous acid in ten millions of water. When no nitrous acid is found, the water is poured off the couple into a stoppered bottle, and, if turbid, allowed to subside. A portion of the clear fluid, more or less according to the concentration of the nitrates in the water, is put into a Nessler glass, diluted if necessary, and titrated with Nessler's reagent in the ordinary way.

This process may be used for the majority of ordinary waters—for those that are coloured, and those that contain magnesium or other substances sufficient to interfere with the Nessler reagent, a portion of the fluid poured off the couple should be put into a small retort and distilled with a little pure lime or sodium carbonate, and the titration of the ammonia performed upon the distillates.

About one square decimetre of zinc should be used for every 200 c.c. of a water containing five parts or less of nitric acid in 100,000. A larger proportion should be used with waters richer in nitrates. The couple, after washing, may be used for two or three

waters more. When either carbonic or oxalic or any other acid has been added to the water, a larger proportion of Nessler reagent should be employed in titrating it than it is usual to add. I have found 3 c.c. to 100 of the water sufficient in almost all cases.

In calculating the amount of nitric acid contained in a water from the amount of ammonia obtained in this process, deductions must of course be made for any ammonia pre-existing in the water, as well as for that derived from any nitrous acid present.

To ascertain the amount of nitrous acid in a water, Griess's latest method should be adopted. A one-half per cent. solution of metaphenylene diamine in very dilute sulphuric acid should be prepared, and a dilute sulphuric acid containing one volume of oil of vitriol to two volumes of water. One c.c. of each of these solutions are added to 100 c.c. of the water in a Nessler glass, and the yellow colouration produced (if any) is imitated by means of a standard solution of potassium nitrite with the same reagents. This standard solution is prepared from silver nitrite, prepared by precipitation, and re-crystallized from boiling water. A weighed amount of this pure dry silver nitrite is dissolved in boiling water, decomposed with a slight excess of potassium chloride, and diluted to a convenient strength. The solution I usually employ contains ·01 of a milligramme of NO_2 in 1 c.c. A solution of ten times this strength is kept in stock in bottles quite filled and tightly stoppered, and is diluted when required for use. To ensure accurate results the solutions to be compared should be simultaneously started and allowed to stand at least twenty minutes before their tints are compared. They should be at the same temperature, for I have observed that the colouration is developed much more rapidly in warm than in cold solutions. There are other conditions which affect the rate of development of the colouration, but these appear to be of a chemical nature and not easily controlled. In these cases only the final tints of the solution should be regarded. The lengthy time required for the full development of the colour, renders it difficult or at least laborious to prepare a solution of exactly the same tint as that under analysis, and it is therefore desirable to adopt some method of making the titration, which, while sufficiently accurate, shall dispense with the necessity for making a long series of trials. I have usually effected this with the aid of Nessler glasses made from pieces of stout glass tubing, about 30 mm. bore and 200 mm. long, ground at the edges and closed at one end with a glass plate cemented on with Canada balsam. The tubes are of exactly equal bore and are graduated from end to end in millimetres. They are used in the following manner: The solution to be titrated and the test solution are made in the usual way, both columns of fluid being of equal length. The test solution is made as nearly as can be guessed to equal in tint that to be titrated. Usually one will be somewhat deeper than the other; the height of the deeper solution is read off upon the millimetre scale, and a portion of it withdrawn by means of a pipette until the shortened column is equal in tint to the other, when its height is again read off. The amount of nitrite in the shortened column is taken as being equal to that in the other glass, and a simple proportion will give the amount of nitrous acid contained in the solution titrated. In this way the titration can be made very expeditiously.

The metaphenylene diamine solution should be decolourized with animal charcoal whenever necessary.

Dr. Dupré said he was very glad that Mr. Williams had given them the paper and hoped

it would be the forerunner of other papers from other chemists who were not actually members of the Society. With regard to the estimation of nitric acid he had the strongest evidence that the indigo process was absolutely useless when certain kinds of organic matter were present. He was certainly not prepared for its absolute failure, but there was no doubt about it, and they must go to another method. He was very favourably impressed with that described by Mr. Williams, and although it might take a longer time than the indigo process for a single water, yet if a number were to be examined it did not much matter, as after starting the waters something else could be gone on with; thus the actual work did not take more time than the indigo process, and in many cases would give accurate results where the indigo process would not. He could certainly speak very strongly of the failure of the indigo method in certain waters, and the probability was that it broke down in nearly every case. It broke down entirely in the presence of urine in water, and almost entirely with albumen in water. It was only an approximate method at best.

[Preliminary Note.]

ON THE ACTION OF PERMANGANATE ON POTABLE WATERS AT DIFFERENT TEMPERATURES.

By G. W. Wigner, F.C.S., F.I.C., and R. H. Harland, F.C.S., F.I.C.

Read before the Society of Public Analysts, on 16th February, 1881.

The criticism to which the series of water analyses now being published by the Society of Public Analysts will be subjected, renders it especially necessary that every detail of the processes used should be placed on such a basis that as far as possible comparison may be made with what has been previously done.

In the case of oxygen absorbed from permanganate of potash, the instructions issued to the analysts have made in two respects a distinctly new departure, viz., the time during which the permanganate is allowed to act, has been increased from three hours, which has hitherto been the general custom, to four hours, and the temperature at which the action takes place has been increased from the 60° adopted by many analysts, or the so-called "normal" temperature adopted by others to a definite standard temperature of 80° F.

Both of these changes have the effect of increasing the amount of oxygen absorbed, but there appear to be no data on record to show what the amount of this increase is. We have therefore made a series of experiments on two water supplies, one being from deep chalk wells and the other a river water, and on one of them after admixture with a definite proportion of urine, and on another portion of the same water after admixture with a definite proportion of raw sugar, thus making four different waters, two of which were purposely contaminated.

We have treated each of these four samples with permanganate by the addition of 100 grains, or, if necessary, more, of the standard solution (each water grain of which corresponds to ·0001 grain of available oxygen) to 1-20th gallon of the water, and titrated the solution back after treatment with hyposulphite of soda in the usual way. This experiment has been made in each case at the different temperatures of 60°, 80°, 90° and 100° F.,

and at each temperature the water has been allowed to stand for one hour, two hours, four hours and six hours.

From this we get two series of figures, one showing the increase in the amount of oxygen absorbed by waters of different degrees of purity, according to the length of time that they remain in contact with the permanganate, and another showing the amount absorbed by the same water, standing for the same time, but at different temperatures from 60° to 100°.

All these results have been obtained in flasks, closed at the top by a glass marble while the action was going on, and the hyposulphite has been titrated with permanganate afresh each day in distilled water.

Another series of experiments, conducted in open beakers, in which specially pure distilled water was in every case worked side by side with the samples, and after standing the full time titrated as a standard, gave results as nearly accordant as may be when the correction found by the distilled water was applied. It will not do, however, to work in this way without this correction.

In one experiment with a sample of water treated with permanganate at a temperature of 70° for three hours, the oxygen actually absorbed in a covered beaker was ·016, and that in an uncovered beaker ·032. In another experiment on a different sample the amount of oxygen actually absorbed in a covered beaker was ·004, and in an uncovered beaker ·028. But the error in each case was always perfectly eliminated by the correction due to the titration of the diluted water standing for the same time.

Taking the chalk water, it will be noticed that the amount of oxygen absorbed in six hours is, speaking in general terms, from three to six times as much as that absorbed in one hour. But the influence of the longer time is shown much more strongly at low temperature than at 100° F.

In the case of the river water the increase of time has not had nearly so much influence.

RESULTS OF EXPERIMENTS WITH PERMANGANATE OF POTASH ON WATERS AND POLLUTED WATERS AT DIFFERENT TEMPERATURES AND FOR DIFFERENT TIMES.

Temp.	Deep Chalk Well Water.				River Water.				River Water, with 200 Grains Raw Sugar added per Gallon.				River Water, with 200 Grains Urine added per Gallon.			
	1 hour.	2 hours.	4 hours.	6 hours.	1 hour.	2 hours.	4 hours.	6 hours.	1 hour.	2 hours.	4 hours.	6 hours.	1 hour.	2 hours.	4 hours.	6 hours.
60°	·002	·006	·012	·018	·064	·072	·080	·086	·078	·104	·130	·160	·350	·390	·420	·478
80°	·006	·010	·016	·024	·070	·076	·088	·110	·094	·112	·192	·280	·388	·400	·476	·520
90°	·010	·014	·020	·028	·076	·084	·104	·118	·110	·174	·292	·486	·400	·476	·524	·618
100°	·012	·016	·020	·030	·084	·090	·110	·126	·112	·260	·544	·944	·460	·520	·584	·674

The difference between the oxygen absorbed at 60° being only about one-third, and at 100° only about one-half.

Taking the case of the sample polluted with urine, the difference between the one hour and six hours determinations is almost the same as in the river water alone, while in the case of the same polluted with sugar the increased action is very much greater, varying from about two-fold to eight-fold.

In the same way the increase of temperature appears to tell on the chalk water in the proportion of something like a two-fold absorption of oxygen at 100° as compared with that at 60°. In the case of the river water about half as much more oxygen is absorbed at the higher temperature as at the lower. The water contaminated with urine shows a slightly higher increase with a higher temperature, while in the case of the water admixed with sugar the increased amount absorbed at the higher temperature is remarkably variable. In one hour the 40° of increased temperature only shows some 40 per cent. increase in absorption; two hours shows an increase of some 250 per cent.; four hours shows some 420 per cent. increase; and six hours nearly 600 per cent.

From these results it is clear that further experiments on waters containing sewage in active decomposition, and on river water in various degrees of purity, and with varying oxidation after contamination, are necessary before we can definitely decide what influence temperature has on this most important reaction.

We have already made some other large series of experiments on the matter in flasks with a water seal, but the experiments are not complete enough to lay before the Society yet.

A PROCESS FOR THE INDIRECT VOLUMETRIC ESTIMATION OF GLYCERIN.

By John Muter, Ph.D., F.I.C.

I have been for some time engaged in an attempt to apply the power of glycerin in arresting the precipitation of cupric hydrate by potassium hydrate to its volumetric estimation. So far as I can discover, no process of the kind has ever yet been proposed for quantitative purposes, and an even fairly accurate method for rapidly estimating glycerin in commercial solutions of it, and in the ley from the saponification of fats, is not in existence. My experiments, although unfinished, give such good hope that the difficulties now met with may be overcome, that I think it advisable to mention the matter as it now stands. At present I can only give the process and its results, as tried on known solutions of pure glycerin, my research into the best methods of separating it from the bodies acting similarly on copper being still incomplete, but such will I hope soon follow, and then the whole will be perfect. Meantime, even a good approximate process to within a per cent. is at least a desirable advance. A great difficulty in getting reliable results, lies in obtaining for such experiments truly absolute glycerin, and although that which I used was supposed to be so, and agreed with the stated specific gravity, still, I do not pretend as yet to lay down the actual power upon copper in figures, but content myself with doing a check analysis with so-called absolute glycerin each time I standardize my solutions. It will be seen from the

subjoined figures, taken at random from a mass of analyses, and showing both the best and the worst results obtained by this method, that the process even now works fairly well:—

Glycerin taken.	Glycerin found.
1·000	·985
·905	·922
·900	·905
·500	·498
·505	·502
·504	·501
·250	·248
·251	·254
·252	·249

The first and second results are the worst I ever had, and were obtained at the commencement of the work, while the others represent the later trials; after experience and employing pure cyanide, they begin to come out very close to the truth.

The process is as follows: Take one gramme of absolute glycerin, and wash it into a long stoppered graduated tube, having a stopcock at 50 c.c. from the bottom. This tube is the same as that used in my process for the rapid estimation of olein in fats (as described and figured in THE ANALYST, vol. ii., page 74, and can be obtained from Messrs. Orme & Co., Barbican, E.C., who sell them as "Muter's Olein Tubes"). Now add 50 c.c. of a strong solution of potassium hydrate (1 in 2), and then a weak solution of cupric sulphate very gradually and with constant shaking, until a fair amount of cupric hydrate is produced which remains undissolved. Make the whole up to a given bulk, and then close the tube and set it aside to settle. When perfectly clear, run off from the tap into a beaker a given volume of the deep blue liquid, and add to it the slightest possible excess of nitric acid; then pour in a definite excess of ammonium hydrate, bring the beaker under the burette charged with volumetric solution of potassium cyanide, and run in till decolourized. The number of c.c. of potassium cyanide used, after calculating to the whole bulk originally in the tube, represents one gramme of glycerin. This result has, however, to be corrected by going through the blank experiment with the same amounts of everything, *but without glycerin*, and deducting the c.c. of cyanide taken from that before found; this is necessary, because cupric hydrate is not quite insoluble in the strong alkali used, but once made and deducted, the difference gives the true value in glycerin of the cyanide solution, and that once standardized, any number of samples can be quickly analysed. I now use absolutely pure potassium cyanide, made from hydrocyanic acid, which I obtain from Germany, together with the absolute glycerin, through the agents of the firm, Messrs. Burgoyne, of Coleman Street, E.C. The source of the small error still apparent lies perhaps to some little extent in not making allowance for the space occupied by the precipitated cupric hydrate, but more especially in the inherent difficulty of working the cyanide estimation of copper to a perfectly constant point. I intend to try Bernsthen's method of titration with sodium hydrosulphite in an atmosphere of hydrogen, with indigo as an indicator, in the hope that it may prove better, but meantime the process can claim to be as accurate as the ordinary cyanide estimation of copper will permit. I am engaged in a re-analysis of butter and other solid fats, with the view of proving, by the aid of this method, whether they are all really triglycerides or not, and hope soon to lay the results before the Society. In minute operations like these, I estimate the copper by electrolysis on platinum, which *gives* the required accuracy.

I may also mention that I am now trying whether better results cannot be obtained by titrating the glycerin-copper solution with pure glucose, or by using excess of glucose, igniting the precipitate with hydrogen, and weighing as metallic copper.

THE ANALYSES OF THE PUBLIC WATER SUPPLIES OF ENGLAND.

We publish in this number the second series of reports on the public water supplies of England, and we are able to include this month a report on the supply of Edinburgh as a first instalment towards monthly reports on Scotch and Irish towns as well. It will be seen that with one exception—Nottingham—we now include analyses of the supplies of every one of the 20 large towns comprised in the Registrar-General's weekly reports, and we hope our next table will contain this one missing place.

As we anticipated in our last issue would be the case, this systematic and uniform series of analyses has excited much interest not only among the authorities of the towns whose supplies have actually been reported upon, but in those of many other towns, some of whom knowing the character of their supplies to be good, were anxious to be included in the scheme, while others, doubtful as to the character of their water, naturally desired to be exempted from it.

We are also enabled in our present issue to give descriptions of the sources of supply and method of filtration (if any) employed in 20 towns not included in the previous report, making a total of 34 reports of this kind published up to this date, and we hope to complete these in our next number by giving similar details with regard to all the other towns.

It is far too early to attempt to go into any detailed examination of the variations which are taking place in the different waters, but one fact is evident to the Water Committee who have examined these reports previous to publication, viz.: that, taking the whole of the supplies the country through, the character of the water supplied in February to the towns reported upon, was almost uniformly worse than that supplied in January. Probably the cause of this may be attributed in some degree to the exceptionally heavy fall of snow which occurred in the latter part of January, and which appears in a large number of cases to have increased the mechanical impurities as well as the dissolved impurities in the waters.

Another advantage which has accrued from this publication has been the determination on the part of a number of analysts to report waters which are sent to them for personal examination and analysis, precisely in the same form that has been adopted by the Water Committee. Such a step must be an immense advantage to the profession at large by ensuring a means of making a fair comparison between analyses made at different times by different analysts, as it is notorious that hitherto there has been no analysis in which such varied forms of reports have been used as in the case of water.

Two more papers on Water Analysis are published in our present number, one of which gives another alternative method for the estimation of nitrates in potable water, which may fairly be submitted to a comparative test as against the three methods already sanctioned by the Committee as a temporary arrangement. This comparison will show whether it possesses any advantages which would entitle it to be used at the expiration of the term of six months as *the* method to be finally adopted.

The offer to send copies of the "Instructions to Analysts" to those interested, has been taken advantage of so extensively, that it has been necessary to issue a second edition

with slight emendations and additions, and the Secretary of the Society of Public Analysts will, as before, be pleased on receipt of a stamped envelope to send a copy to anyone who may desire it.

The difference between the analysis of the Kent supply in January and that published in this number is accounted for by the fact that the sample has come principally, if not entirely, from a different well. We hope next month to be able to print the analyses of the water taken simultaneously from all the different wells of this company.

The analysis given under the heading "Trafalgar Square Well Water" is from the Artesian well in that square used to supply the fountains, and a small portion of which is, we are informed, also used for drinking purposes.

PROVINCIAL TOWNS.

Bradford.—The supply is obtained from three sources—1, The moors above Oxenhope (high level); 2, Springs at Chellow Dean (intermediate level); 3, Reservoirs at Barden and Chelker (low level). The total capacity of the reservoirs is 1,154,000,000 gallons, and the daily consumption 7½ to 8 million gallons. The geological formation of the sites of the reservoirs is the carboniferous, peat, clay, millstone grits, and shales, with a few beds of coal. The water, although slightly coloured with peat, is very soft and good.

Birmingham.—The sources of supply of this water are of two kinds—first, from certain streams outside the town, viz., the river Bourne, the Perry and Witten and Plants brooks; and, second, several deep wells sunk into the red sandstone. The waters from these two very different sources are mixed in reservoirs before distribution, and the portion derived from streams is submitted to filtration more or less perfect.

Bristol.—The Company commence to take their supply from the Chew Hill Head Spring on the Mendip Hills, about 16 miles from Bristol and 430 feet above the Bristol Floating Harbour. From this point the "line of works" passes through the parishes of Litton, East and West Harptree, Chew Stoke, and Winford, with about ten miles of iron tubes and tunnel driven as much as 170 feet from the surface of the ground. Some deep-seated springs are taken up *en route.* At the Winford end of the tunnel the water is discharged into the store reservoirs at Barrow Gurney, about 4½ miles from Bristol, 300 feet above the Floating Harbour. At Barrow Gurney rises the Cold Bath Spring, which is also taken. These constitute the gravitation sources of supply. Water is also obtained, when required, by pumping from deep wells at Chelvey, near Nailsea, about nine miles from Bristol.

Derby.—The supply is derived partly from springs in the millstone grit at Little Eaton and Cocksbench, and partly from two 9 ft. culverts, which run along for some miles on either side of the Derwent, at a distance of 21 feet from the river, and below the level of the river bed. These culverts are built of bricks without mortar, about 4 inches thick, and are immediately surrounded by several feet of coarse gravel. They are filled with water from the hills on either side of the river. The waterworks are at Little Eaton, some two and a-half miles from the town, and here the culverts are connected by two 24-inch iron pipes which pass under the river. The water rises in two wells and flows into a reservoir at the works, which also receives the water from the springs. It is pumped up thence into filtering beds consisting of 18 inches fine sand, 1 foot fine gravel, 1 foot coarse gravel, 18 inches boulderstones, 18 inches rough sandstone, and falls by gravitation into the town. The supply is about 1¼ million gallons daily, of which about 900,000 gallons are derived from the springs at Little Eaton and Cocksbench.

Droitwich.—This water has been supplied to the town within the last two years, all water being previously saline. Prospecting for water a hill of gravel and pebbles (a glacial drift) was found measuring 4 miles by ½ mile, and containing water the chlorine in which did not exceed 8 grains per gallon. Round the area the chlorine ranged from 12 to 72 grains. Borings were made which gave a good water. Mr. Prichard, C.E., put in numerous star adits, with large stoneware pipes pierced with holes as at Warwick. 60,000 gallons per day are delivered, being pumped up from a reservoir, into which the adits fall, to a covered tank 100 feet above the level, and then delivered to the town by gravitation. The water is generally very pure, but the late snows and heavy floods have evidently polluted it, falling into the adits at a lower level. A few feet below the adits the water is saline.

Grantham.—The water is derived from the Oolite limestones to the south of the town. A portion comes from springs and headings in the water-bearing strata at Stroxton, about three miles from the town. This is delivered by gravitation through iron pipes to the service reservoir. The larger portion is collected from various springs at Little Ponton, extending to a distance of two miles from the town; and conducted by an iron main to a reservoir at the pumping station whence it is pumped up to the service reservoir. Some water was formerly taken from the Stoke River, a tributary of the Witham, and from a spring at Great Ponton. Both these sources of supply were objectionable, the river water not only being very turbid after rain, but being also polluted with sewage above the intake, and the spring being subject to surface pollution. The supply was much improved last year by ceasing to take water from the last two named sources, and by increasing the size of the collecting main from Little Ponton, whereby the yield of pure spring water is greatly augmented. The service reservoir is 133 feet 6 inches above the level of the centre of the town. It is covered over and has a capacity of 678,600 gallons. The water is delivered to the town on the constant system. The works belong to a private company formed in 1850. (This supply will only be reported on bi-monthly. See ANALYST for January, page 22.)

Hull.—The supply is from the underlying chalk strata, which stretch for miles all around. The gathering grounds are to the N. and W. of the town. The natural outflows of the underground waters are various springs in the low-lying districts and the broad channel of the Humber. The site of one very copious outflow at Springhead—4 miles west of Hull—was 18 years ago made into a pumping station; shafts and bores were sunk and the supply now exceeds 6,000,000 gallons per day, drawn from a mean depth of 50 feet below the surface. The overplus of the night's pumping is sent into reservoirs at Stoneferry, 3 miles from Springhead, and these supply an extra engine which assists the Springhead engines during the working hours of the day. As the town increases steadily, and the supply in ordinary seasons is very little beyond the demand, new works are now in progress for increasing this supply. An adit or tunnel 4,000 feet long and from 50 to 60 feet below the ground level is under construction. It is intended that new bores at and near the end of this adit shall send additional water to the Springhead pumping shafts. The adit will also form a useful underground reservoir.

Liverpool.—This supply is derived from two distinct sources: viz., from a gathering ground at Rivington, near Chorley, and from deep wells in the red sandstone formation. The water thus obtained is mixed, generally in about the proportion of two parts of Rivington and one part of well water, previous to distribution. The gathering ground at Rivington is partly of a peaty nature, but in other respects is well adapted to the purpose. Of the wells there are four, or counting the Bootle deep borehole, five. Of these the Green Lane Well supplies the greatest quantity. The population supplied is about 700,000—the service being constant.

Llandrindod.—This water is collected in the Radnorshire Hills, and after passing over a large surface of Trap rock, with veins of calcareous spar, is stored in a reservoir, which is cut out of the rock and covered over, from whence the water is distributed to the houses by gravitation.

Newark-on-Trent.—The water is derived from a series of culverts dug in the gravel by the side of the Trent for a distance of fifty yards, about two miles above the town. The water filters through the gravel into the culverts, and is pumped into a covered service reservoir having a capacity of 500,000 gallons, situated on some high ground outside the town. The water is delivered directly from the mains on the constant system.

Plymouth.—This water is derived from the peat bogs on the Dartmoor granite hills, passing through an open seat about twenty miles in length. After heavy storms from the south-west it is frequently much stained with peat, and it also contains salt driven in from the sea. At ordinary times it is very soft, of fair colour, and of good quality, though there is said to be much room for improvement in the filtering arrangements.

Portsmouth.—The water is obtained from copious surface springs which rise from chalk, partially in the parish of Bedhampton and partially in the parish of Havant, eight miles from Portsmouth, from whence it is pumped into reservoirs, the capacity of which is 8,000,000 gallons, on Portsdown Hill, two and half miles from and about 140 feet above the town; from thence it descends by gravitation and is distributed over the district. The supply is constant, and the Company supplies an estimated population of 135,000 people.

Reading.—Reading and its suburbs have a constant service from the works, which are in the hands of the Corporation. The water is derived from the River Kennet. The intakes are about two miles above the town. There are two sets of works pumping by water power with auxiliary steam power at times. The older works pump by water wheels to large reservoirs in the Bath Road, holding about four days supply, filling through filters of small superficial area with twelve feet of water above five feet of gravel, shingle and sharp sand. The water filters too quickly and under pressure. The new works pump by turbines. They have two settling reservoirs and three filters each about thirty yards square. The subsidence is assisted by the water being caused to pass upwards and then over a wall or weir before it enters the filters. The filters have three feet of gravel and sand, with about two feet of water above, so that they filter more slowly and under less pressure than at the older works. None of the filters or reservoirs are covered from the sun, and during flood time the filters require constant cleaning. Both works are used at times. Above Reading there is the town of Newbury not yet sewered, at a distance by the windings of the river of about twenty miles. The river runs through a flat open country, but is liable to floods both winter and summer, when much vegetable and inorganic matter gets washed down.

Rugby.—The water supply is principally derived from the drainage of pasture lands. Advantage being taken of the gradient, the water flows to a settling tank, passes through a filter bed, and is pumped up to a tank on the top of a tower. In dry weather, when the surface supply is short, water is pumped from a reservoir near the river Avon, which is kept filled from a well in the immediate vicinity.

Sevenoaks is supplied with water from a well about 120 feet deep, sunk through Kentish rag into the Folkestone Beds, and about one-third of a mile from the town; but a portion of the water comes from a tunnel close by. The supply is ample, there being sufficient (at 15 gallons per head per day) to supply a town of 35,000 inhabitants. It is pumped from this well into a covered reservoir by Knole Park and near the Tunbridge Road from whence it descends by gravitation to the town. The Company are now building a new

concrete reservoir, about 150 feet higher than the present one, to supply the increasing wants of houses built on a higher level. The consumption, during 1880, was less than 14 gallons per head per day, including trade and street watering. (This supply will only be reported on bi-monthly. See ANALYST for January, page 22.)

Stourport.—This water is supplied by the Kidderminster Water Works, and is derived from an Artesian well, shaft 120 feet, then 10-inch borehole 600 feet; and also from another well, 35 feet, with a 10-inch borehole 200 feet deep, from the new red sandstone. The quantity supplied is about two million gallons per diem.

Sunderland.—The water supplied to this borough is obtained from the dolomite or magnesian limestone, by means of shafts sunk to a depth of 46 fathoms, at Ryhope, Seaham, Dalton-le-Dale, Humbledon Hill, Cleadon, and Fulwell, and is in the hands of the Water Company, who, in addition to Sunderland, also supply Ryhope, Seaham, North and South Hylton, Ford, Boldon, South Shields, Jarrow, and Hebburn. The delivery last year was at the rate of 4,593,000 gallons per day. The supply per head of the population of Sunderland—exclusive of that supplied for manufacturing purposes, which average 10 gallons a day—is at the rate of 12 gallons per day, making a total of 22 gallons per head per day supplied for all purposes. The supply is continuous, so that practically there is no limit as to its use.

Whitehaven.—This has a constant water supply, derived from Ennerdale Lake, about nine miles distant from the town. The water is conveyed in iron pipes, coated with Dr. Angus Smith's preparation. It is not filtered. The service reservoir, situated outside the town, is small and uncovered. The substrata of the Ennerdale valley (the source of the supply, consists of clay slate (skiddow slate) highly altered, Ennerdale syenitic granite, and Borrowdale series of volcanic rocks.

Wolverhampton.—The supply is about 2½ million gallons per day, 1½ million gallons of which is derived from the River Worf at Cosford, about nine miles from Wolverhampton and three from Shifnal in Shropshire. The balance of the supply is well water, of which the main portion (say ¾-million gallons) is derived from an Artesian borehole into the new red sandstone at Cosford; but about ¼-million gallons come from the new red sandstone by two other wells, situated respectively at Goldthorn Hill and Tettenhall pumping stations, within a mile or two of the town.

Worcester.—The water is taken from the Severn one mile above the city, passed through filter beds of sand and gravel (which are cleansed weekly), then pumped up to a reservoir on a hill, and supplied by gravitation to dwelling houses. 1,600,000 gallons are pumped daily. The water contains peat and (whitewater) kaolin from the decomposition of feldspathic rocks in Montgomeryshire. The purest water, and largest in quantity, is derived from the river Vyrnwy, which joins the Severn a few miles above Shrewsbury. Pollution of Severn: flannel mills, lead mines, zinc, sewage of Newtown and Welshpool. Pollution of Vyrnwy: peat and kaolin, sewage of Oswestry. Pollution of Severn after junction: sewage of Shrewsbury, Bridgnorth, Stourport, mills refuse of Kidderminster and Stourport, salt refuse of Droitwich. The oxidation of pollution in the Severn is very remarkable, chiefly owing to the admixture of Vyrnwy waters, which partly also dilute the polluted waters. "White Water" cannot be removed by the sand filter beds. At present the town water is not so good as usual, owing to the continued floods.

SOCIETY OF PUBLIC ANALYSTS.

Analyses of English Public Water Supplies in February, 1881. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine.	Phosphoric Acid.	Nitrogen as Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in		Hardness, Clark's Scale, in degrees.		Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
								2 mins. at 80° Fahr.	4 hours at 80° Fahr.	Before Boiling.	After Boiling.			
Kent Co.	greenish	v. slight	1·84	none	·8488	none	·0087	none	·0340	17·4°	4·5°	30·00	satisfactory	Wigner & Harland.
New River	c. yellow	none	1·05	traces	·2420	·0026	·0028	·0084	·1132	15·1°	4·4°	19·88	none	B. Dyer.
East London ..	greenish	v. slight	1·20	h. traces	·3000	·0014	·0071	·0020	·0760	16·6°	8·0°	24·80	satisfactory	Wigner & Harland.
Southwark & Vauxhall ..	yellowish	slight	·99	traces	·1200	·0007	·0112	·0045	·1120	14·0°	7·5°	20·16	satisfactory	J. Muter.
West Middlesex	urine yellow	none	1·026	traces	·1550	·0009	·0078	·0020	·1190	14·2°	3·9°	19·16	amorphous matter	O. Hehner.
Grand Junction	clear	none	1·20	traces	·1477	·0007	·0064	·0078	·0796	14·4°	4·6°	21·00	none	A. Wynter-Blyth.
Lambeth	yellowish	none	·99	traces	·1200	·0022	·0133	·0045	·1232	16·0°	7·0°	21·88	satisfactory	J. Muter.
Chelsea	c. greenh. brown	none	1·06	trace	·1800	none	·0067	·0070	·0714	16·5°	6·0°	21·00		A. Dupré.
Birmingham ..	s.turb.f.grn.ylw	none	1·40	traces	·2160	·0028		·0028	·0470	11·6°	4·9°	18·83	veget. debris, minl. mattr.	A. Hill.
Bradford	f. dirty yellow	none	·75	none	none	·0007	·0077	·0280	·1800	4·3°	3·7°	7·80	amorphous peaty matter	F. M. Rimmington.
Brighton......	c.pale green blue	none	2·20	none	·2000	none	·0048	none	none	12·6°	4·2°	24·80	satisfactory	Wigner & Harland.
Bristol........	f.brownsh. green	none	·79	trace	·0520	none	·0035	·0043	·0280	16·3°	1·2°	21·40	sand diatoms desmids	F. W. Stoddart.
Cambridge	pale blue	none	1·40	h. traces	·2300	·0035	·0042	·0010	·0103	17·4°	5·0°	25·20	satisfactory	J. West-Knights.
Canterbury	c. pale blue	none	1·47	none	·3380	·0007	·0007	·0040	·0170	7·0°	5·0°	10·92	traces mineral	S. Harvey.
Croydon	slight green	slgt. earthy	1·19	traces	trace	·0070	·0140	none	·0136	15·5°	6·5°	23·00	none	C. Heisch.
Derby	v. good	none	·90	none	·0432	·0010	·0035	none	·0357	13·5°	5·7°	19·60	satisfactory	L. Archbutt.
Droitwich	bluish green	none	2·25	none	·1564	none	·0098	none	·0700	36·7°	4·2°	39·48	vegetable debris, sand	H. Swete.
Dudley	greenish	none	1·52	none	·2635	·0021	·0042	·0030	·0655	16·6°	6·1°	25·48	veget. debris, mycelium	H. Swete.
Edinburgh	brownish	none	·72	none	trace	·0016	·0056	·0160		5·9°	5·4°	7·68	peaty matter	J. F. King.
Exeter	f. yellow turbid	none	·91	trace	·1772	·0006	·0042		·0568	2·7°	2·7°	7·00	diatoms cotton fibres	F. P. Perkins.
Huddersfield ..	brownish yellow	f. rain watr.	·45	none	·0035	·0126	·0049	·0040	·0142	2·0°	2·0°	4·50	peaty matter	G. Jarmain.
Hull	good	none	3·00	traces	·2760	·0046	·0030	·0030	·0230	15·6°	3·4°	19·30	satisfactory	J. Baynes.
King's Lynn ..	dirty yellow opaque	dcyd. veget. matter	2·46	h. traces	·4364	·0032	·0028	·0264	·1263	15·5°	4·6°	22·82	bacteria diatoms and a leech	W. Johnstone.
Leamington ..	greenish	none	1·26	trace	none	·0021	·0021	·0084	·0161	28·0°	15·9°	28·00	satisfactory	A. B. Hill.
Leeds	light brown	peaty	·62	traces	none	·0005	·0042	·0168	·1316	4·0°	3·0°	5·32	sand, peaty matter	T. Fairley.
Leicester	urine yellow	none	·92	trace	·1700	·0006	·0146	·0040	·1680	7·9°	4·1°	14·00	vegetable matter	Wigner & Harland.
Liverpool	light brown	peaty	1·02	traces	·0620	·0028	·0014	·0140	·1120	5·2°	4·6°	9·24	satisfactory	A. Smetham.
Llandrindod ..	bluish green	none	·71	none	·0250	·0007	·0063	·0005	·0316	7·2°	2·6°	9·66	vegetable debris	H. Swete.
Maidstone	c. colourless	none	2·45	trace	1·2880	·0014	·0028	·0238	·0630	16·0°	5·3°	32·07	satisfactory	M. A. Adams.

Analyses of English Public Water Supplies in February, 1881. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine.	Phosphoric Acid.	Nitrogen as Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in 2 mins. at 80° Fahr.	Oxygen, Absorbed in 4 hours at 80° Fahr.	Hardness, Clark's Scale, in degrees. Before Boiling.	Hardness, After Boiling.	Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
Manchester....	v. s. turbid	none	·49	none	none	·0019	·0029	·0139	·0924	1·6°	1·5°	4·76	s. mineral deposit	W. Thomson.
Newark	yellowish brwn. turbid	none	1·12	trace	·0079	·0012	·0088	·0098	·1382	16·0°	10·8°	26·93	amorphous organic mttr. mvng. organms.	A. Ashby.
Newcastle-on-Tyne......	f. yellow	none	·878	trace	·0510	·0010	·0090	·0060	·0950	15·7°	6·2°	20·50	amorphous	J. Pattinson.
Norwich	p. grnsh. yellow		1·55	f. traces	f. tracs.	traces	·0100	·0029	·1031	15·0°	4·2°	18·20		W. G. Crook.
Oldham, Piethorn	yellowish green, slight opaque	veget. mttr.	·71	trace	·1000	·0098	·0050	·0040	·1000	2·4°	2·3°	6·30	vegetable debris, hair	Wigner & Harland.
Do. Strinesdale	ple. grnsh. tinge	veget. mttr.	·85	trace	·1700	·0082	·0152	·0040	·0800	5·2°	4·9°	11·80	vegetable debris, sand	
Do. Hanging-Lees	pale greenish yellow	veget. mttr.	·78	trace	·2000	·0083	·0043	·0040	·0860	2·2°	2·2°	8·06	veget. debris and fibres	
Plymouth	yel. grn. s. opaq.	veget. mttr.	·95	none	·0500	·0010	·0116	none	·0640	5·0°	5·0°	5·00	algæ animalculæ	
Pontefract	f. yellow	slight	3·72	traces	9·1000	·0005	·0050	·0056	·0500	40·0°	28·8°	50·40	trace sand	T. Fairley.
Portsmouth ..	v. turbid	none	1·26	traces	·2620	·0032	·0042	·0056	·0333	14·6°	3·9°	19·74	vegetable debris much decomposed, diatoms	B. Dyer.
Reading	c. f. yellow	none	·95	trace	·1400	·0007	·0056	·0140	·0700	14·0°	4·5°	17·40	amorphous matter	J. Shea.
Rugby	turbid yellowish	none	1·18	h. traces	·3150	·0056	·0126					18·90	iron rust from pipes	A. P. Smith.
Salford	yellow	v. slight	·60	none	none	·0010	·0050	none	·0150	3·5°	3·0°	4·00	satisfactory	J. C. Bell.
Sheffield	turbid brown	none	·50	none	none	·0021	·0056	none	·1050	5·0°	4·8°	6·03	none	A. H. Allen.
Shrewsbury ..	v. s. yellow	none	1·39	traces	·3700	·0030	·0060	·0040	·0280	20·8°	5·2°	24·80	vegetable fibres	T. P. Blunt.
Southampton..	f. greenh. yellow	none	·98	h. traces	·1423	·0056	·0041	·0080	·0680	12·3°	4·0°	19·70	vegetable debris	A. Angell.
Stourbridge ..	greenish blue	none	2·30	none	·0123	·0014	·0042	·0010	·1176	16·7°	5·2°	31·36	sand, vegetable debris	H. Swete.
Stourport	turbid grnh. yellow	none	2·10	none	·6176	·0028	·0031	·0010	·0720	7·1°	1·5°	9·80	sand, vegetable debris	H. Swete.
Sunderland....	c. pale blue	v. slight	1·95	trace	·2500	·0017	·0028	·0060	none	9·6°	3·7°	25·00	vegetable debris	H. J. Yeld.
Swansea	c. yellow	none	·90	traces	none	·0007	·0070	·0020	·0040	2·5°	2·0°	4·55	none	W. Morgan.
Whitehaven ..	f. green	none	·36	trace	·0114	none	·0018	none	·0113	·5°	·5°	3·10	vegetable debris, moving organisms	A. Kitchin.
Wolverhampton	v. turbid	none	1·26	h. traces	·1610	·0007	·0119	·0033	·1299	14·4°	7·0°	20·44	veg. deb. amœbæ. diatms.	B. Dyer.
Worcester	brown opaque	slight	1·83	trace	·0290	none	·0084	·0010	·1680	10·4°	5·8°	15·54	moving organisms, animal and vegetable debris, sand, clay	H. Swete.
Trafalgar Sq., Well Water, Lon.	c. pale, grnsh. yellw.	none	11·70	trace	trace	none	·0022	none	·0031	8·0°	1.0°	57·96		A. Dupré.

Abbreviations:—c., clear; f., faint; h., heavy; p., pale; v. h., very heavy; v. s., very slight.

ERRATA.—In last month's table the Oxygen of the CROYDON water absorbed in 4 hours should have been ·0130 instead of ·0300.

DRUG ADULTERATION IN AMERICA.

REPORT ON DETERIORATIONS, ADULTERATIONS, AND SUBSTITUTIONS OF DRUGS, RECENTLY PRESENTED BY MR. C. LEWIS DIEHL TO THE AMERICAN NATIONAL BOARD OF HEALTH.—*National Board of Health Bulletin: Supplement No. 6.*

Mr. Diehl does not give a re-assuring account of the purity of drugs in America. His report shows, amongst other adulteration, the following :—

ROOTS, ETC., ETC.	ADULTERATION.
Aconite	Exhausted *(tasteless)* dried root.
Arnica	Only 10 to 50 per cent. of the true root.
Hydrastis	Contained 50 per cent. beet root, serpentaria, sanguinaria, and podophyllum.
Sarsaparilla	Nutgalls, ipecac., matico stems, *paper*, bark, straw, bay, belladonna, and digitalis leaves.
Whole Pepper	Acorns "*turned*" *into small globes and dyed.*
Peppercorns	Made up of oil cake, clay, and cayenne.
Pepper of light weight	Macerated in brine to increase weight.
Ground Pepper	Pepper leaves, sage, rape seed, potato, spices, capsicum, guinea pepper, chicory, size, laurel leaves, olive stones, bone dust, dirt.
Quinine	Finely picked cotton, salicine.
Santonin	Mica, boracic acid 22 per cent., picric acid 100 per cent. (all p. a., *no* santonin).

Mr. Diehl mentions that there was till recently in Brussels "an extensive establishment for adulteration carried out with great skill."

Ships' biscuit seems to enter into the adulteration of many powdered and other drugs. Thus :—

Cape Aloes	Contained Cape aloes, *ships' biscuit*, turmeric.
Ipecac. / Opium / Gamboge, &c.	,, *Ships' biscuit 25 to 50 per cent.*
Scammony	,, *Ships' biscuit*, cocoa beans, lampblack, &c.

CORRESPONDENCE.

[The Editors are not responsible for the opinions of their Correspondents.]

LARD ADULTERATION.

To the Editor of "The Analyst."

Sir,—I am afraid "An Interested Chemist" did not notice the point of my letter, or else I did not make it sufficiently clear. I did not find fault with the lard having too *high* a melting point, but too *low* a one. In Wynter-Blyth's book, the melting point is said to vary from 107·6° to 113° F. I am perfectly aware that the lard is pressed to extract the oil, but that would not account for the melting point *falling* to 92°. Some lard that I prepared myself, and which had not been pressed, melted at 112·6°.

Again, granting, for the sake of argument, that pressed lard is better suited for culinary purposes,

the shop lards that I tried were decidedly inferior in this respect, for I purposely experimented with each in making pastry. The lard having the lowest melting point made the worst crust, it scarcely rose a bit, and was tough; whereas the pure article made a puff paste an inch thick. I have been told by a grocer in this town that the lard manufacturers melt down *all* the pig's fat. If so, it is wrong to call the product lard. It has no more right to bear that name than dripping has to be called suet. I think it probable that this may be the true explanation of the difficulty, since I find bacon fat melts at 90°, and I did not observe any marked differences in the proportions of soluble and insoluble acids.

I am, &c.,

RUGBY, *12th Feb., 1881.* A. PERCY SMITH.

AMMONIA IN WATERS.

To the Editor of "The Analyst."

Sir,—In the determination of free and albuminoid ammonia in waters, I have always had a difficulty with regard to the connection of the retort with the condenser. I had a large number of glass tubes made about 27-in. long, 1⅛-in. bore one end and tapering to ⅜-in. bore at the other end. The neck of the retort, wrapped with tin foil, I inserted in the condensing tube. These tubes were continually breaking on the slightest strain or bumping of the retort; besides, the steam inside the tube and the cold water on the outside had also a tendency to make the glass more liable to fracture. Again, the securing of the glass tube in the condensing box was difficult to contend with—indiarubber tubing, bound up carefully, would, after a little time split. At last I resolved to try condensing tubes of the above size, made of block or fine tin. They were made by Messrs. Johnson, Matthey & Co., and I have found them to answer admirably. The tubes are connected with the condensing box by means of solder, this doing away with any possible leakage. Before using them in water analysis, I found it necessary to steam them out; that is by connecting the retort and distilling off a litre or two of water through the tubes, the condenser being empty meanwhile. Any brother analyst, having the difficulties to contend with as I used to have, will find it advantageous to try the above. I may add, the condenser I used is a copper box about 15-in. long, 5-in. deep and 3½-in. wide. This filled with water stands firmly on a stand made for it, the tin condenser passing obliquely through the box.

Yours faithfully,

SWANSEA, *Feb. 22nd, 1881.* W. MORGAN.

ANALYSTS' REPORTS.

Mr. Alfred Stokes, Public Analyst for the parish of Paddington, in his report for the quarter ending December 25th, 1880, mentions a sample of milk which contained no less than 40 per cent. of added water, and a sample of whisky which was diluted with 76 per cent. of water.

At the Quarterly Meeting of the Bristol Town Council, recently held, Mr. F. W. Stoddart, Public Analyst, presented his report for the past quarter, in which he said he had received from the inspector and the public seventy-one samples of food, and of these he found twelve to be adulterated and one to be unfit for food. A sample of butter forwarded by one of the public was found to contain less fat than butter. Five samples of butter forwarded by the inspector were found to be genuine. Two samples of coffee and chicory, three samples of mustard farina, two samples of mustard, and two samples of coffee, all furnished by the inspector, were found to be genuine.—In a discussion which took place on a report of the Watch Committee, Mr. A. W. Warren said he wished to call attention to the article sold in shops under the name of butterine. It was sold largely retail in Bristol, and he saw in London notice was being taken of the article, and the public were protected from it. He thought the public should be protected in Bristol, and the Watch Committee ought to take steps relative to the sale, as the stuff was sold in enormous quantities. It was a combination of low fats treated in a chemical way and coloured with annatto: but there was no butter in it. The stuff was sold as butter, and he hoped that this and other articles, which were sold under other names than what they really should bear, would receive proper attention.—Mr. H. G. Gardner, wholesale grocer, said he agreed with the statement that articles should not be sold under other names than what they really bore, but he would be sorry to see wholesome fat prohibited from being sold to poor people, as butter was at such a high price. Butterine was quite wholesome, and the only objection he had to it was when it was sold as butter; and he had as much objection to that as Mr. Warren could have. But, for goodness' sake, let it be sold! The fat was as wholesome as butter, and half the price.—Mr. A. Baker did not think they need discuss the merits of butter and butterine, but the attention of the Public Analyst should be called to all kinds of articles of

food, and not merely to one; let justice be meted out all round.—Mr. M. Whitwell said he had been in America and seen the whole process of making butterine, and, although it contained no butter, it was, he could say, an extremely wholesome article. It was made from the best fat that could be got, the stearine removed, and then churned with milk.—Mr. Cordeux said the attention of the analyst had been directed to other articles besides butter during the quarter. The discussion then dropped.

LAW REPORTS.

Butter or Butterine?—

At the Aston Police Court, Birmingham, on Feb. 5th, before Messrs. A. Hill, J. D. Goodman, and J. T. Collins, William John Bryant, dairyman, of 160, Aston Road, Birmingham, was summoned by Benjamin Bolt, an inspector under the Sale of Food and Drugs Act, for selling one pound of butter not of the nature, substance, and quality demanded by the purchaser. Mr. J. Ansell appeared for the prosecution. On the 10th ult. the inspector sent a youth into defendant's shop for a pound of tenpenny "butter," with which he was supplied. The inspector then went into the shop and told the defendant that the butter would be analysed. The defendant's sister, who had served the butter, said it was not butter, but "butterine" or "oleine." In reply to Mr Buller, solicitor, who appeared for the defendant, prosecutor said he was not deceived, as he believed it was butterine or oleine. Mr. Buller for the defendant contended that as the actual purchaser did not state that the butter was bought for the purpose of analysis, the summons could not be supported. He also urged that there was no such an article as "tenpenny butter," and that the lowest price for butter was 1s. 2d. per pound. The defendant was in the habit of placing a ticket on the article describing it as fine oleine, but on the morning in question the ticket was taken away to be cleaned. The magistrates considered the case proved, and fined the defendant 5s. and costs. Mr. Buller asked for a case on the point he had raised that the purchaser did not state the butter was for analysis, and the magistrate granted a case.

At West Bromwich Police Court, on Monday, Mr. Thomas Brady, grocer, Meeting Street, was charged with selling adulterated butter on the 17th inst. Mr. Topham appeared for the defendant. Alfred Toy, assistant inspector, stated that when he entered the defendant's shop he asked the daughter who was behind the counter, to sell him one pound of butter, which she did, and for which he paid 1s. 2d. Mrs. Brady afterwards came in and said that she had the butter from Mr. Garratt, wholesale dealer, West Bromwich. The price of salt butter was now 1s. and upwards per pound. Mr. Horder, inspector under the Act, said that a sample of the butter had been sent to the analyst, who certified that it was a fictitious article, containing 8 per cent. of butter fat. For the defence it was stated that Toy went into the shop and asked Mrs. Brady for a pennyworth of milk, and while she went into the dairy to fetch it, Toy asked her daughter to supply him with "that pound of butter" which was in the window. While the daughter was in the act of reaching the butter to Mr. Toy, Mrs. Brady came back with the milk, and said that it was not butter, but oleine, and that it was from Mr. Garratt, of West Bromwich. Toy said he supposed it was made at West Bromwich, and he therefore divided the article into three parts. The case was dismissed.

Constituents of Chemical Food for Infants:—

Sheriff Balfour, of Glasgow, had before him, on the 10th inst., a case in which a grocer carrying on business in that city was charged with contravening Section 7 of the Sale of Food and Drugs Act, 1875, he having on the 13th ult. sold a bottle of compound syrup of phosphates, or chemical food for infants, which was represented to contain, in every teaspoonful, two grains and a half phosphate of lime and one grain of iron, but which when analysed was found to contain only about a third of a grain of phosphate of lime and a quarter of a grain of iron. He was liable to a penalty of £20. The accused tendered a plea of guilty, and Mr. Bell, who appeared on his behalf, briefly addressed the Court. He pointed out that his client bought the bottles from a manufacturing chemist wholesale, and did not know the ingredients. He also mentioned that the difference in price between the "food" as sold and as it should be sold was only ½d. per lb. The Sheriff observed that the offence was not a serious one. His Lordship imposed a fine of £3.

Selling Diluted and Impoverished Milk:—

James Dearnley, milk dealer, of Almondbury Bank, Huddersfield, was charged with selling diluted and impoverished milk. Mr. Kirk, the sanitary inspector, said that on the 24th December he saw the defendant hawking milk in Moldgreen, and he instructed a person named William Beaumont to obtain from him a pint of milk. He obtained the milk, for which he paid twopence. He (Mr. Kirk) was in a position to hear what was said. As soon as Beaumont had paid for the milk he informed the defendant

at he had bought it for the sanitary inspector, whereupon the defendant said he was having him on;" and asked him where Mr. Kirk was. He (Mr. Kirk) then went up to him, took hold of the ilk, told him he was the sanitary inspector, that he had bought the milk for analysis, and asked him he wished to retain a part of it. He had no sooner said that than the defendant seized him by the ght arm, tried to upset the vessel containing the milk, and he so far succeeded that three parts of it ere spilled; but there was a sufficient quantity retained for analytical purposes. Witness reminded im of the serious position in which he was placing himself, when the defendant said he was determined should not have any of his milk. The milk was analysed, and the analyst's report showed that it ntained 42 per cent. of added water, and it had also been deprived of 85 per cent. of its butter fat! itness said it was one of the worst cases he had ever had; and Mr. Jarmain, the Borough Analyst, said never before analysed so bad a sample. This, he said, took place when there was an outbreak of arlet fever in the town, and when the patients were requiring a milk diet. The defendant said r. Kirk was exaggerating the case, and he was sorry it had arisen. The defendant said the milk was id as he got it from other farmers, but, on being pressed by the Bench for their names, he was unable give one of them! The Chief Constable informed the Bench that in June, 1879, the defendant was ned £5 and costs for a similar offence, and Mr. Kirk added that in that case the whole of the cream d been removed. The defendant asked the Bench to be as merciful as possible. He was told that e case was a serious one, and he ought to sell good milk. He would be fined £10 and costs, and the ayor said he richly deserved a heavier penalty.

NOTE OF THE MONTH.

The National Board of Health of the United States of America, which, at the present time, really seems to be doing a large amount of extremely useful work, has just issued the following notice, which clearly shows that the authorities on the other side of the Atlantic are becoming aware, like ourselves, of the great necessity there is for a uniform nd systematic analysis of Public Water Supplies :—

A careful study of the chief methods in use for the chemical examination of potable ater, so far as organic matter is concerned, has been undertaken by order of the National oard of Health. It is particularly requested of the correspondents of the board, of edical men throughout the country, and of others interested in sanitary matters, that any ell-marked case of disease which may seem on medical grounds fairly attributable to rganic impurities in drinking water be promptly reported to Dr. J. W. Mallet, University f Virginia Post-office, Albemarle County, Virginia, with a few lines stating clearly the edical nature of the case, and the character of the evidence on which the water in question s suspected of having actually caused disease in persons who have used it.

It is further desired that a sample of each such water be forwarded for examination, ut not *until notice has been received from Dr. Mallet that the analysts are ready to proceed ith it*, since it is important that no useless delay should occur between the shipping of the ample and its investigation in the laboratory. In notifying any one who may be able to urnish specimens of suspected waters that may be forwarded, clear instructions will be sent s to the quantity of water required, and the mode of collecting, packing, and shipping it.

It is particularly desired that no case be presented on doubtful or vague evidence, since he important object of the inquiry demands that all such be rejected, and only those ases examined which involve the strongest grounds for believing that mischief has really een caused by organically foul drinking water.

The cost of packages and transportation for samples will be borne by the Board f Health.

In order to distinguish genuine butter from so-called oleomargarine, Hager, we read, saturates a cotton-wick with the melted sample, lights, and allows it to burn for two minutes, and judges its quality by the smell. Artificial butter gives the well-known offensive odour of an extinguished tallow candle.—*Provisioner.*

A public laboratory for the analyis of anything sold as food has been established in Paris by the Prefect of the Seine, the fees being limited to from five to twenty francs, according to the difficulty of the operations.—*Provisioner.*

Dr. Ebenezer Evans has been appointed Public Analyst for the county of Anglesey, at one guinea per analysis, vice Owen, resigned.

Mr. James Napier, F.C.S., has been appointed Public Analyst for the borough of Sudbury, at five guineas per annum and fees.

Mr. A. W. Stokes, F.C.S., has been appointed Public Analyst for the parish of St. Matthew, Bethnal Green, vice Tidy, resigned.

RECENT CHEMICAL PATIENTS.

The following specifications have been recently published, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

No. 1880	Name of Patentee.	Title of Patent.	Price.
2516	C. D. Abel	Manufacture of Betanaphthylamine, &c.	2d.
2605	G. W. Von Nawrocki	Mechanically Incorporating Indiarubber with Hydro-Carbon Oils	2d.
2610	J. H. Johnson	Telephones	6d.
2665	W. R. Lake	Protective and Insulating Casings for Underground Telegraph Wires	6d.
2682	E. A. Kirby	Treatment of Meat	4d.
2706	F. N. Mackay	Manufacture of Snow	6d.
2719	C. G. Pfander	Preparation of Materials for Clarifying Sugar Oils, &c.	
2729	L. Perrier	Steam Tension Manometer for Analysing Liquids and Studying Pressures	6d.
2736	J. H. Johnson	Manufacture of Alcohol	4d.
2764	G. G. André	Electric Lamps	8d.
2784	A. Domeier and J. Marzell	Manufacture of Artificial Alizarin	4d.
2816	E. Edmonds	Carburetting Air	6d.
2826	J. Imray	Telephones	2d.
2831	T. H. Gray	Treatment of Vegetable Oils	4d.
2865	J. A. Lund	Synchronising or Setting Clocks	2d.
2878	F. A. Zimmermann	Manufacture of Bitter Almond Oil, Benzoic Acid, &c.	4d.
2885	W. Brierley	Extracting Ammonia during Distillation of Azotic Substances	2d.
2902	B. H. Remmers & J. Williamson	Refining or Purifying Sugar, &c.	4d.
2929	G. O. Willis	Medicated and other Aerated Waters	2d.
4091	J. A. Dixon	Colouring Matters for Dyeing and Printing	4d

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; Journal of Applied Science; The Boston Journal of Chemistry; The Provisioner; The Practitioner; New Remedies; Proceedings of the American Chemical Society*; Le Praticien; The Inventors' Record; New York Public Health; The Scientific American; Society of Arts Journal; Sanitary Engineer of New York; The Cowkeeper and Dairyman's Journal; The Chemists' Journal; Oil and Drug News; The Textile Record of America; *Sugar Cane; Practical Chemistry*, by Hurst & Madan.

THE ANALYST.

APRIL, 1881.

SOCIETY OF PUBLIC ANALYSTS.

A GENERAL MEETING of this Society was held at Burlington House, on Wednesday, the 16th March, the President, Mr. Heisch, in the chair.

The President announced that in accordance with the resolution passed at the Extraordinary Meeting, held on the 16th February, the Council had elected Mr. F. Maxwell Lyte, as the second secretary of the Society for the remainder of the current year. Mr. Lyte was too well known for it to be necessary for him to say one word, except that it was a very good thing for the Society to have obtained his services.

A letter from Monsr. E. Chevreul, accepting the Honorary Membership, was read and ordered to be entered on the minutes, and that letter and those from Dr. Hofmann and Professor Fresenius, which were read at the previous meeting, were, if possible, also to be published.

Dr. Bartlett and Mr. B. Dyer, having been appointed as Scrutineers to open the ballot papers, announced that the following gentlemen had been elected :—As Members—John Parry, Public Analyst for Penryn; W. D. Sykes, M.D., Public Analyst for Portsmouth; H. Liepmann, Ph.D., F.C.S., Analytical Chemist, of Leadenhall Street, London. As Associates—W. Fox, Assistant to Mr. J. Baynes, of Leeds; D. A. Sutherland, Assistant to Dr. Drinkwater, of Edinburgh.

The following gentlemen were proposed for election as Members, and will be balloted for at the next Meeting :—W. L. Emmerson, M.D., &c., Public Analyst for the County of Leicester, &c.; H. Meadows, M.B., Public Analyst for the Borough of Leicester; R. Oxland, F.C.S., Public Analyst for Plymouth and Devonport; W. F. K. Stock, Public Analyst for Durham.

The following papers were then read and discussed: "The Swedish Acts for regulating the Sale of Poisons," by C. Heisch, F.C.S., F.I.C.

"Some Analyses of Milk," by Bernard Dyer, F.C.S., F.I.C.

"On Samples of Milk which have fallen below the Society's Standard," by J. Carter Bell, F.C.S., F.I.C.

"On a New Method for the Estimation of Nitrates in Potable Water," by J. West-Knights, F.C.S.

"Nitrates in River Waters," by F. P. Perkins, F.C.S.

The following are the letters from the recently elected Honorary Members referred to above :—

MUSEUM D'HISTOIRE NATURELLE, PARIS, *13 de Février, 1881.*

CHER MONSIEUR,—Après avoir lu votre lettre, et pris connaissance du groupe des Savants auxquels le Conseil de la Société a bien voulu associer mon nom, on ne peut croire, quel que fut l'opinion que l'on eut de la valeur de ses propres travaux, qu'on se trouva pas honoré d'appartenir au groupe des honoraires

de la Société nouvelle. Veuillez donc, Monsieur, donner connaissance de cette lettre,—en réponse à celle que vous m'avez adressée,—au Conseil de la Société, afin qu'il sache, de moi-même, que celui qui s'honore du titre de doyen des étudiants de France, ne peut que s'honorer du titre de membre honoraire de votre Société. Si ma vie scientifique a été heureuse, c'est d'avoir eu de la nation Anglaise, qui a été si grande, a mon sens, dans toutes les branches des connaissances humaines, des titres de son estime, pour des travaux dont le but, en toutes choses, a été la verité. Que le Conseil sache donc, combien je en'honore d'être le doyen des associés étrangers de la Société Royale de Londres, comme je la suis de l'Académie des Sciences de l'Institut de France, et quelle m'ait jugé digne de lui appartenir.

Veuillez, Monsieur le Secrétaire Honorâire, agréer l'expression de mes sentiments de haute et profonde estime.

E. CHEVREUL.

10, Dorothein Strasse, Berlin.

DEAR SIR,—I hasten to acknowledge the letter informing me of the great distinction the Society of Public Analysts have conferred upon me by electing me their Honorary Member. I deem it indeed a great honour to belong to so important and useful an association as the Society of Public Analysts has rapidly become, and this honour in my eyes is doubled by its coming from dear old England, so long the country of my adoption, and of which as long as I live I shall always bear a most grateful recollection.

Will you be so good as to convey the expression of heartfelt thanks to my new colleagues for the honour they have done me.

And believe me, dear Sir, ever yours very sincerely,

G. W. Wigner, Esq., Hon. Sec. Society Public Analysts. A. W. HOFMANN.

Wiesbaden, 10th February, 1881.

DEAR SIR,—In receipt of yours of the 5th inst., I shall be glad to accept the election as an Honorary Member of your esteemed Society, by which you pay a great compliment to my researches in analytic chemistry.

Accept my best thanks on behalf of yourself and your Society for the honour you confer on me.

With compliments, I am, yours truly,

G. W. Wigner, 79, Great Tower Street, London, E.C. C. R. FRESENIUS.

The next Meeting of the Society of Public Analysts will be held at Burlington House, on Wednesday, the 13th April.

ON A NEW METHOD FOR THE ESTIMATION OF NITRATES IN POTABLE WATER.

By J. WEST-KNIGHTS, F.I.C., F.C.S.

THE most delicate test we have for nitric acid is undoubtedly the brucine test, and perhaps it is one of the most delicate tests in the whole range of analytical chemistry, for the red colour produced by it from one part of nitrogen as nitrate, is distinctly perceptible when diluted with ten million parts of water: and yet, so far as I am aware, this test has never been made a quantitative one.

This may, perhaps, be accounted for in the fact that in using this test in the ordinary way, with excess of HNO_3 (as in testing for brucine), or with excess of H_2SO_4 (as in testing for nitrates), the red colour is destroyed almost as soon as produced, the result being an orange or brown colour, the intensity of which is diminished, or the colouration altogether disappears.

But if certain precautions be taken the blood-red colour is perfectly permanent.

If oxalic acid be employed instead of sulphuric, in applying the test to nitrates, and *provided* that the nitrate is not present in greater proportion than one molecule of NO_3 to

one of brucine the red colour is produced permanently, not only from nitrates of the alkaline earths but also from nitrates of the alkalies.

To apply this to the estimation of nitrates in water, it is merely necessary to evaporate a measured quantity of water to dryness, moisten the residue with solutions of brucine and oxalic acid, again evaporate to dryness, dissolve the red residue in water, filter and compare the colour with a standard red colour, produced in the same way from a weighed quantity of nitrate of potash. The solutions required are :—

Nitrate of Potash Solution.—·721 grm. of pure nitrate of potash are dissolved in one litre of distilled water ; one c.c. of this solution contains ·0001 grm. of nitrogen as nitrate.

Brucine Solution.—Dissolve one grm. of brucine in 100 c.c. of alcohol ; each c.c. contains ·01 grm. brucine.

Oxalic Acid Solution.—A cold saturated solution.

Standard Red Solution.—Evaporate 10 c.c. of nitrate of potash solution to dryness in a platinum dish over a beaker of boiling water, moisten the residue with 3 c.c. of brucine solution and about 6 drops of oxalic acid solution, and again evaporate gently to complete dryness, moisten the red residue with a few drops of distilled water and once more evaporate to complete dryness, dissolve the residue in a little distilled water on the water-bath, wash the solution into a hundred c.c. flask and fill up to the mark with distilled water. This solution should have a bright red colour, with no appearance of orange or brown even when considerably diluted ; 1 c.c. is equal to ·00001 grm. of nitrogen as nitrate (the same strength as the dilute ammonia used in nesslerizing).

The sample of water is now prepared in a similar manner : 10 c.c. are evaporated to dryness, and brucine solution added to the residue in sufficient quantity, from 0·5 c.c. to 2 c.c. according to the quantity of nitrate present. It is advisable not to have a large excess of brucine, but it is absolutely necessary for the production of a full red colour that there should be a slight excess, or at least an equivalent. As a first trial 1 c.c. may be used, which will generally be found sufficient, but if the colour produced is a decided brown and not comparable with the standard red, a fresh quantity of the water must be taken and more brucine solution used until the result is satisfactory ; if on the contrary, a very slight pink colour is produced, indicating 1 or 2-10ths of a grain of nitrogen as nitrates per gallon, a smaller quantity should be used. Three or four drops of oxalic acid should be added and the whole gently evaporated to complete dryness, moisten the residue, which, if enough brucine has been used will be perfectly red, with a few drops of water and again evaporate ; now dissolve the residue on the water-bath in a little water and filter into a white glass cylinder marked at 50 c.c. and fill up to the mark with water ; now imitate the colour exactly in another cylinder by using from 1 c.c. to 10 c.c. of the standard red made up to 50 c.c. with water. If the colour produced by the 10 c.c. of water is deeper than that produced by 10 c.c. of the standard red, it must be diluted with one or two volumes of water and 50 c.c. used as before ; if it is lighter than 1 c.c. of the standard, then 20 c.c. or 30 c.c. of the water must be evaporated instead of 10 c.c.

When 10 c.c. of water are used, the number of c.c. of standard red required to produce a similar tint multiplied by 7 and divided by 100 equals grains per gallon of nitrogen as nitrates.

Although so small a quantity of water as 10 c.c. is employed for the estimation of nitrates by this method, and in fact 1 c.c. may be used in some cases, it is fully as accurate

as the aluminium method, for although in that method a much larger quantity of water is taken initially, the actual estimation takes place in the same amount as in the brucine method, and not only is the red colour more striking to the eye than the yellowish-brown colour in nesslerizing, but it is also permanent and does not change on standing.

I give below estimations of nitrates in two samples of water both by the brucine and aluminium methods, the samples were selected as giving a fairly low and a very high proportion of nitrates respectively.

Cambridge Water.—March Sample.

N. as Nitrates	·460	grs. per gallon	Al. Method.
" "	·455	"	" Brucine "
" "	·490	"	" " "
" "	·462	"	" " "

A Polluted Well Water.

N. as Nitrates	4·270	grs. per gallon	Al. Method.
" "	4·200	"	" Brucine "
" "	4·550	"	" " "
" "	4·200	"	" " "

I regret I have not had time to bring forward a larger number of analyses to support the accuracy of this process, but the whole operation is so simple and speedy that I am led to hope that some of the members of this Society, especially those that are connected with the water scheme, will give it a fair trial and communicate the results to the Society.

ON THE ESTIMATION OF NITRATES IN RIVER WATER.

By Frank P. Perkins.

Read before the Society of Public Analysts on 16th March, 1881.

Many are the processes that have been devised for the estimation of nitrates; nevertheless, the method here described may, perhaps, be found worthy of your consideration: not the less so from its constancy and extreme simplicity. I have observed that if 100 c.c. of the water to be examined are put into a perfectly bright and freshly ignited platinum dish, together with a very small portion of sodium chloride (the commercial salt may be used if previously ignited to get rid of any trace of organic matter it may contain), on introducing into the saline liquid a coil of magnesium (made from a piece of ribbon about three feet in length by simply coiling it round a glass rod, and subsequently cleansing it from oxide by immersing it in dilute hydrochloric acid and washing with water), immediately that contact between the platinum and magnesium is gained, electrical action ensues and the water is decomposed. At first the action is somewhat slow, but in a very few minutes a torrent of minute gas bubbles ascends through the liquid. Should the water contain nitrates these are reduced—through the action of the nascent hydrogen—and converted into ammonia. A slight elevation of temperature considerably hastens the decomposition, but in practice nothing is gained by this. During the experiment the platinum dish is covered with a clock glass, then placed on a plate of ground glass, and for further security a small bell jar, the mouth of which is also ground, is inverted over it, contact with the air being thus in a great measure prevented. Thus it rests during the night, or until the whole of *the magnesium is dissolved.* The convex surface of the clock glass is then rinsed with pure

distilled water into the dish, and the electrolysed liquid, or a measured portion thereof, transferred to a flask, and the ammonia distilled off and nesslerized in the usual way.

As a platinum dish of the required size may not always be at hand, it has been my endeavour to arrange the experiment in a less costly manner without detracting from its completeness. The following arrangement will be found all that can be desired on this score. Into a wide-mouthed four-ounce bottle a round plate of platinum foil, perfectly clean, and of about the same diameter as the interior of the vessel, is placed and allowed to lie flat and loose on its bottom. To the mouth of the bottle a sound cork is fitted (a caoutchouc stopper must not be used) and through its centre a piece of quill tubing a few inches long, drawn out at one end to a fine orifice, and filled with beads or minute fragments of glass, is passed. Into this apparatus the water prepared as already shown is placed, and the coil of magnesium having been dropped in and the contents of the little tube moistened with water, the cork is fixed firmly in position and the decomposition allowed to proceed. At the conclusion of the experiment the little tube (which may contain traces of ammonia) and the under surface of the cork are rinsed into the larger vessel, the loss of ammonia being thus prevented. The determination of the ammonia is then made, a correction for the amount of free ammonia originally contained in the water being of course necessary. The working of the process will be seen from the following experiments.

EXETER WATER.—Per 100,000 parts.

No. 1	·2587	Nitrogen as Nitrates.
No. 2 (another sample)	·2802	,, ,,
The same water treated by the Al. process gave ...	·2583	,, ,,

---

In the discussion on the papers on Nitrates in Water, by Mr. West-Knights and Mr. Perkins,

Dr. Muter said they were scarcely in a position to discuss them at present, but it was very gratifying that the younger members of the Society should be coming forward so well lately. He suggested the desirability of postponing any discussion till they had had an opportunity of trying the processes.

Dr. Dupré said it seemed to him that the real way to get at nitric acid was to convert it into ammonia. It was the only philosophical way. The Brucine method laboured under the same disadvantage as the Indigo process—they did not know exactly what it gave, and it differed with various waters.

Mr. West-Knights, in replying, said that the Brucine test must not be put on a par with the Indigo process, because some compound of Brucine had, he believed, been produced in a crystalline form, and, therefore, it was quite as much a definite process as the Ammonia process.

SOME ANALYSES OF MILK.

By Bernard Dyer, F.C.S., F.I.C.

Read before the Society of Public Analysts, on 16th March, 1881.

In the course of some experiments on the feeding of dairy cows, recently carried out under my joint supervision in Sussex, I have had occasion to submit to analysis a large number of samples of milk from several cows, including weekly samples of morning and evening

milk during a period extending over some months. In the course of these investigations a large number of samples, the genuineness of which was quite above question, differed so materially from the standard adopted by the Society of Public Analysts, that I have thought it worth while to bring some of the results before the Society. I do not propose here to refer in detail either to the general system or the results of the experiments themselves, which were undertaken to ascertain the comparative value of certain foods, as affecting the gross yield of milk. The analyses were made in order to ascertain what fluctuations in quality might accompany fluctuations in actual yield, and although merely incidental to the practical questions involved from the farmer's point of view, they naturally constitute the chief point of interest to our Society.

COWS A. AND B. (A. Pure Bred, B. half bred.)

These were Sussex cows that had calved a few weeks previously to the first analysis and were apparently in perfect health.

The following analyses were made while the cows were fed on a pure grass diet, on good pasture land without any artificial food whatever:—

	A.					B.			
	Total Solids.	Fat.	Solids not fat.	Ash.		Total Solids.	Fat.	Solids. not fat.	Ash.
July 2nd	12·86	3·94	8·92	·68	..	11·88	3·15	8·73	·72
„ 8th M.	12·91	3·76	9·15	·69	..	12·03	3·14	8·89	·70
„ 8th E.	13·31	3·79	9·52	·69	..	12·45	3·40	9·05	·69
„ 9th M.	12·42	3·06	9·36	·68	..	12·38	3·62	8·76	·71
„ 9th E.	14·63	5·81	8·82	—	..	11·92	3·27	8·65	—
„ 17th M.	12·42	3·36	9·05	·65	..	12·28	3·40	8·88	·65
„ 17th E.	12·99	3·97	9·02	·67	..	11·80	3·32	8·48	·69
Average	12·80	3·64	9·16	—		12·10	3·33	8·77	—

During the above period the quantity of milk yielded by B., exceeded that yielded by A. by 27 quarts a week. The cows then received, in addition to grass, a liberal allowance of good oil-cake.

	A.					B.			
	Total Solids.	Fat.	Solids. not fat.	Ash.		Total Solids.	Fat.	Solids not fat.	Ash.
Aug. 4th. E.	12·29	3·30	8·99	·66	..	11·95	3·55	8·40	·70
„ 5th. M.	12·76	3·57	9·19	·67	..	11·89	3·51	8·38	·68
„ 11th. E.	13·36	4·17	9·19	—	..	12·49	3·69	8·80	·70
„ 12th. M.	14·80	5·56	9·24	—	..	12·13	3·17	8·96	·65
„ 18th. E.	15·24	6·28	8·96	·70	..	12·38	3·52	8·86	·71
					..	12·69	3·61	9·08	—
Average	13·69	4·58	9·11	—		12·25	3·51	8·74	—

Up to this point B. was giving 90 quarts per week, being 30 quarts in excess of A. On Aug. 19th, however, A. suddenly fell off in her milking, and was removed from the experiments, having maintained a pretty steady average of 9·1 per cent. of "solids not fat." The sudden rise in fat on and after Aug. 12, follows an increase in the quantity of oil-cake, but is probably due to the abnornal conditions which caused her to fall off in her milk shortly afterwards. The experiments were continued, substituting for A., cow C., a shorthorn. An analysis of this cow's milk on grass only, on July 27th, gave—

C.		
Total Solids.	Fat.	Solids not fat.
13·39	4·48	8·91

The analyses of B. and C. were continued from the date at which A. was set aside, both cows being fed on grass and oilcake.

		C. Total Solids.	Fat.	Solids not fat.	Ash.		B. Total Solids.	Fat.	Solids not fat.	Ash.
Aug. 17th.	E.	13·41	4·59	8·82	·74	..	—	—	—	—
„ 18th.	M.	12·96	4·07	8·89	·67	..	—	—	—	—
„ 25th.	E.	13·22	4·87	8·35	·69	..	12·45	3·96	8·49	·69
„ 26th.	M.	11·12	2·40	8·72	·65	..	12·17	3·51	8·66	·71
Sept. 9th.	E.	11·54	2·55	8·99	·70	..	11·81	3·33	8·48	·69
„ 13th.	M.	14·04	4·83	9·21	·70	..	12·90	4·10	8·80	·64
„ 28th.	M.	14·11	4·58	9·53	·70	..	13·67	4·84	8·83	·68
„ 29th.	E.	15·23	5·79	9·44	·67	..	12·67	3·85	8·82	·67
Average		13·20	4·21	8·09	—		12·61	3·93	8·68	—

At this time B. had gradually decreased in her yield, but was still giving 75 quarts per week. C. was not doing so well as regards quantity, and the cows were then taken indoors, this stage of the experiments having been concluded.

It will be noticed that B., throughout the three months, averaged only 8·7 per cent. of solids not fat, and only on one occasion was the limit of the Society actually reached, viz., on Aug. 19th, when the morning milk yielded 9·08 per cent. of solids not fat. Judged by the 9·3 per cent. standard, this milk, although perfectly genuine and from a healthy well-fed cow, would have been pronounced to be adulterated with 6 to 7 per cent. of water, while on one occasion the dilution would have estimated at 10 per cent., when in reality there was no dilution at all. Later in the year when B. was being stall-fed, and had little or no exercise, I had occasion to make some further analyses, and found the quality of her milk altogether different.

		B. (Stall-fed). Total Solids.	Fat.	Solids not fat.	Ash.
Nov. 18th.	E.	14·94	4·81	10·13	·80
„ 19th.	M.	16·04	5·91	10·13	·74
„ 24th.	E.	14·30	4·12	10·18	·78
„ 25th.	M.	14·74	5·03	9·71	·67
Dec. 1st.	E.	14·66	4·80	9·86	·74
„ 2nd.	M.	14·41	5·02	9·39	·74
„ 8th.	E.	13·14	3·40	9·74	·77
„ 9th.	M.	13·84	4·50	9·34	·71
Average		14·51	4·70	9·81	—

I now refer to some analyses obtained in experiments made on stall-fed cows, E. and F., but I first give analyses of the milk of these two cows, while still on grass and oil-cake. The cows were a cross between Shorthorn and Jersey. The stall feeding begins on Oct. 31st.

		E. Total Solids.	Fat.	Solids not fat.	Ash.		F. Total Solids.	Fat.	Solids. not fat.	Ash.
Sept. 6th.	E.	11·63	2·26	9·37	·69	..	12·51	3·62	8·89	·71
„ 8th.	M.	13·16	3·99	9·17	·71	..	14·78	5·87	8·91	·71
Oct. 31st.	E.	13·19	3·12	9·56	·68	..	13·13	4·29	8·84	·71
Nov. 1st.	M.	14·25	3·13	9·71	·75	..	13·20	4·09	9·11	·73
„ 8th.	E.	13·60	3·82	9·78	·68	..	12·56	2·93	9·63	·71
„ 9th.	M.	14·01	4·03	9·98	·77	..	13·59	4·46	9·13	·78
„ 14th.	E.	13·01	3·65	9·36	·74	..	13·43	2·81	9·16	·67
„ 15th.	M.	13·67	4·01	9·66	·81	..	13·90	2·95	9·33	·80
„ 21st.	E.	14·28	4·70	9·58	·71	..	15·26	6·12	9·14	·77
„ 22nd.	M.	14·06	4·32	9·74	·71	..	14·11	4·40	9·71	·77
„ 28th.	E.	14·17	4·54	9·63	·77	..	13·51	4·17	9·34	·71
„ 29th.	M.	13·34	3·38	9·96	·76	..	13·77	4·74	9·03	·71
Dec. 5th.	E.	15·01	5·38	9·63	·74	..	13·50	4·27	9·23	·73
„ 6th.	M.	14·13	4·55	9·58	·71	..	12·66	3·50	9·16	·71
„ 12th.	E.	14·10	4·50	9·60	·71	..	13·06	3·12	9·43	·75
„ 13th.	M.	12·97	3·96	9·01	·74	..	13·11	2·93	9·02	·70
Average		13·66	4·08	9·58	—	..	13·20	4·01	9·19	—

The foregoing analyses illustrate what has frequently been pointed out before—that stall-fed cows give richer milk than cows at grass, even when supplied with additional food in the shape of oil-cake, and they give good examples of the great variations to which the milk, even of individual cows, is subject. It will be said, of course, that, as a rule, the Public Analyst has not to deal with the milk of individual cows, but with the mixed milk of several cows; and that the chances are in favour of the mixed milk, when pure, coming up to or above the limit fixed by the Society. In the produce of large dairies this is probably true; but the fact that an individual cow in good health and well fed can frequently give milk yielding on an average only 8·7 of solids not fat should make us cautious in giving certificates of adulteration. It will be noticed that, although in these earlier analyses Cow B only averages 8·7 of solids not fat, her fat, nevertheless, rises to about 3·5, giving total solids about 12·2. This is an excess of 1 per cent. over the minimum of fat fixed by the Society; but, still, the milk, judged on the "solids not fat" basis, would be deemed adulterated. And it must be admitted, to my mind at all events, that a person purchasing genuine milk, containing even only 8·5 per cent. of "solids not fat" with 3 per cent. or 3·5 of fat, gets better value for his money than if he purchased "standard" milk, containing 9 per cent. of "solids not fat" with 2·5 of fat. The proportion of fat should be very carefully considered, in conjunction with the "solids not fat," before an opinion as to adulteration is pronounced.

SAMPLES OF MILK WHICH HAVE FALLEN BELOW THE SOCIETY'S STANDARD.

By J. Carter Bell.

Read before the Society of Public Analysts on 16th March, 1881.

It has been my custom for some years when I receive a sample of milk which I consider adulterated, to trace that milk to its source and to find out whether the addition of water was contributed by the farmer, or by the milk dealer, or whether they were both innocent and the impoverished milk was really due to the half starved cow, and out of the many hundred samples which have passed through my hands only in about two instances have I found it necessary to differ from the standard laid down by this Society. I consider this fact to be a very great proof of the fairness of this standard.

The first instance in which the milk fell below the standard was the following. On the 18th of April, 1879, I received a sample of milk from Crewe, which gave—

Total solids	10·40
Solids not fat	8·00
Fat	2·40
Ash	·61

I wrote to the Inspector asking him to obtain a sample of milk direct from the cows. On April 23rd another sample was sent, which was taken just as the milk left the cowshed; this milk gave—

Total solids	10·75
Solids not fat	8·30
Fat	2·45
Ash	·68

I was not satisfied with this sample, but wrote to the Inspector and told him he must send me a sample of milk which he had seen taken from the cows himself. A third sample was taken from two cows, on the evening of April 24th, in the presence of the Inspector.

The total solids were	10·08
Solids not fat	8·07
Fat	2·01
Ash	·65

On May 1st I went over to the farm, and found seven half-starved cows, looking like animated bundles of bones—so miserable was their appearance. A little hay was all their food. The cows were thoroughly milked in my presence, and the milks yielded the following results :—

Specific Gravity	1031	1029	1031	1028	1038	1028	1031
Total solids	10·61	11·10	12·34	9·10	12·00	10·59	11·57
Solids not fat	8·11	8·38	9·35	8·04	9·80	7·98	8·89
Fat	2·50	2·72	2·99	1·06	2·20	2·61	2·68
Ash	·69	·65	·69	·75	·72	·64	·73

The second instance which has fallen under my notice was from a gentleman's farm in Cheshire. The farm was kept up for his pleasure, but managed by a person who did not understand cow keeping. The milk was sent into Salford, and a sample of it gave—

Total solids	11·12
Solids not fat	8·50
Fat	2·62

I visited the farm and saw 22 cows in the shippons. Each cow was milked in my presence, and each sample analysed; the mean of the lot was—

Total solids	11·42
Solids not fat	8·55
Fat	2·87
Sp. Gr.	1030

The two extreme cases were—

Specific gravity	1030	1028
Total solids	13·71	10·70
Solids not fat	9·37	7·92
Fat	4·34	2·78

This poorness of milk I attribute to bad feeding; for I asked that better food might be given to a cow, and I would examine the milk at the end of a week, which I did, and found it equal to the Society's standard.

The following are a few examples of milk bought from farmers in the streets, and milk supplied by the farmers' cows milked in my presence :—

	Milk bought from farmers in the street—						Milk from same farmers' cows—					
	1	2	3	4	5	6	1	2	3	4	5	6
Specific Gr.	1026	1025	1028	1028	1027	1024	1032	1033	1033	1034	1033	1034
Total solids	12·10	12·34	11·65	10·47	10·40	10·0	13·76	13·22	13·50	13·50	13·63	12·92
Solids not fat	8·06	8·40	8·50	7·32	7·81	7·3	9·56	9·52	9·60	9·39	9·80	9·72
Fat.. ..	4·04	3·94	3·15	3·15	2·59	2·7	4·20	3·70	3·90	4·11	3·80	3·20

In each of the above cases, a summons was issued against the farmer, and a conviction obtained.

In numbers one and two I should have hesitated to declare the milk adulterated unless I had visited the farms.

I think there is little doubt that when a milk only yields 11·5 per cent of total solids it has been tampered with, and such a case should be thoroughly investigated by the analyst.

In the discussion on the two papers on milk analysis, by Messrs. Dyer and Carter Bell, Dr. Muter said it was the old story, viz., that cows were occasionally met with whose milk gave startling results ; but there were a great number of other cows which did

not, and a little of their milk mixed with the others—for it was not with the milk of one cow alone they had to deal—would soon raise the low figure. He wished Mr. Dyer had given the ash, and hoped it would be added to the paper before it was published. He always liked to see the ash, because he had found that where the ash was taken it was a good guide—a much better guide than many analysts thought—and the ash corresponded with the solids not fat to such an extent that any analyst who was desirous of checking the work of his assistant could do so very well by those two determinations alone. As regards a standard Dr. Muter did not think the Society's standard had been at all affected, because it was an open question whether to starve a cow was not simply another way of adulterating the milk. It they were to go round England and milk one thousand cows, and tabulate the analyses, and take only those in which the solids not fat, fat, and the ash, agreed—rejecting those analyses in which either were only a point or two out—he ventured to say that they would not find twenty that would fall below 8·9, and not more than one which would fall below the Society's standard, which he did not think ought to be lower than it was. In conclusion he pointed out the importance of not relying on any one constituent, but of judging on the analytical results as a whole, and disregarding a slight departure from the average of solids not fat if compensated for by an increase in fat itself.

Dr. Dupré said he had repeatedly given certificates in cases where the solids not fat had been 8·6 or 8·5, and the vendors had paid the fines imposed on conviction. He considered the specific gravity of a milk was of much more importance than many analysts seemed to consider. It appeared to him that the specific gravity of some of the milks referred to did not correspond with some of the other figures. His experience was that a milk of over 1030 specific gravity was almost always up to the Society's standard. The specific gravity should always be given, as it was, he thought, the best guide they could have of the correctness of the analysis. Dr. Dupré also thought that no analyses should be published without being duplicated, and also that the process used should always be stated.

Mr. Hehner said there was, undoubtedly, some proof that the solids not fat fell below 9·0 in some cases, and if that figure was a little too high then 2·5 was rather low for the fat. If any alteration was made at all it must not only be in the solids not fat, but the fat must be raised.

Mr. Dyer, in reply, said that very many of his analyses were made in duplicate and some in triplicate. As to the ash, no doubt it was very important, but he thought Dr. Muter went a little too far in saying that, if the ash did not exactly accord, it proved the analysis incorrect, because nature did sometimes vary her operations.

THE WORK DONE BY PUBLIC ANALYSTS UNDER THE SALE OF FOOD AND DRUGS ACTS DURING 1880.

In accordance with the custom we have adopted for several years past, we have prepared forms for collecting these details, and have sent them, we believe, to nearly every Public Analyst in the United Kingdom. We have received a very large number of the returns and are collating them for publication in our May number. If any Public Analysts who have not received these forms will send a post card to the publishers, copies shall be sent to them at once. We shall, however, be glad to have them returned to us as early in the month as possible.

REVIEW.

Report of the Annual Meeting of the British Association at Swansea. Swansea: TWENEY & Co.

This is a handy little reprint of the most important papers read at the Meeting, with notes of the discussions thereon. These notes are well put together and add to the value of the pamphlet.

BAKING POWDERS IN THE UNITED STATES.

From the New York Tribune.

INTERESTING TESTS MADE BY THE GOVERNMENT CHEMIST.

DR. Edward G. Love, the present Analytical Chemist for the Government of the United States has recently made some interesting experiments as to the comparative value of baking powders. Dr. Love's tests were made to determine what brands are the most economical to use. And as their capacity lies in their leavening power, tests were directed solely to ascertain the available gas of each powder. Dr. Love's report gives the following:

"The prices at which baking powders are sold to consumers I find to be usually 50 cents per pound. I have therefore calculated their relative commercial values according to the volume of gas yielded on a basis of 50 cents cost per pound."

Names of Baking Powder.	Available Gas. Cubic Inches per each ounce Powder	Comparative Worth per Pound.
"Royal" (cream tartar powder)	127·4	50 cts.
"Patapsco" (alum powder)	125·2	49 "
"Rumford's" (phosphate) fresh	122·5	48 "
" " old	32·7	13 "
"Hanford's None Such"	121·6	47¾ "
"Redhead's"	117·0	46 "
"Charm" (alum powder)	116·9	46 "
"Amazon" (alum powder)	111·9	44 "
"Cleveland's (short weight ¾ oz.)	110·8	43 "
"Czar"	106·8	42 "
"Price's Cream"	102·6	40 "
"Lewis's" condensed	98·2	38½ "
"Andrews' Pearl"	93·2	36¾ "
"Hecker's Perfect"	92·5	36 "
Bulk Powder	80·5	30 "
Bulk Aerated Powder	75·0	29 "

NOTE.—"I regard all alum powders as very unwholesome. Phosphate and tartaric acid powders liberate their gas too freely in process of baking, or under varying climatic changes suffer deterioration."

PRIVATE WELLS OF SOUTHAMPTON.

THE following are figures obtained from analysis of a sample of water taken from a private well in Southampton, the water at the time being in daily use for all domestic purposes. It is very remarkable from the enormous amount of saline ammonia present, and is an example of the fearful pollution of which town wells are liable. The water was fairly presentable to the eye and was not unpalatable; the distillate from carbonate of soda smelled strongly ammoniacal, and, of course, gave a strong alkaline reaction. Parts per 100,000:—

Free NH_3.	Albumd. NH_3.	Nitrates. = N.	Cl.	P_2O_5	Solids.	Per. H.	Total hardness.
5·68	0·0332	1·9026	2·2	v.h. traces.	41·7	6·2	14·5

Microscopical examination—Starch grains, paper, animal hairs.

A. ANGELL.

THE ANALYSES OF THE PUBLIC WATER SUPPLIES OF ENGLAND.

WITH this month's issue of the Society's water reports we publish the first instalment of a periodical series of analyses of the water from the sources of supply. It is obvious that as many companies have various different sources of supply—sometimes as many as eight or ten—we cannot at present undertake to publish the reports on all of these monthly; but an occasional analysis of each will throw, we hope, much additional light on the causes of the variations in the character of the water as delivered, and may, in some cases, lead to the condemnation and abandonment of a bad spring or well.

The uniform system of analysis has already been productive of much good in enabling analyses to be more accurately compared; and the Water Committee are now engaged, under the direction of the Society, in amplifying the instructions so as to provide for every detail in the analytical work, and ensure such data as shall enable concurrent opinions to be given in every case.

These amplified instructions will be published in THE ANALYST as rapidly as possible from month to month.

It is not at present in the view of the Committee to introduce any new process; but in order to make the instructions as complete as possible they are considering, and as far as possible testing, any suggestions that may be made with a view to rendering the instructions complete.

PROVINCIAL TOWNS.

Dublin is supplied with water taken from an artificial lake or reservoir about 26 miles distant from the city, and situated in the mountains of the county of Wicklow. It is filtered at the reservoir, but the supply to the city is taken from an uncovered service reservoir, about five miles from the city. It supplies about 335,000 persons, and the consumption is about 30 gallons per head per day.

Edinburgh.—In 1824 water was brought from Crawley springs and Glencone Burn, in the centre valley of the Pentland hills, forming a large compensation reservoir in that valley. This new supply gave an addition of 250 cubic feet a minute, or 2,250,000 gallons a day, or in all 290 feet a minute.

Additional water was brought in from the Barelaw Liston Shields and Blacksprings on the north side of the Pentland, and from additional burn water which required the construction of large reservoirs, chiefly for compensation and the enlargement of Glencone reservoirs. Those works were finished in 1852. This gave an additional supply of 230 cubic feet a minute. There were now seven reservoirs having an aggregate capacity of 174,000,000 cubic feet.

In 1856 an additional supply of spring water was brought in from Colyium and North Liston Shiels on the north side of the Pentland, at the distance of about 14 miles, giving an increase of about 250 cubic feet a minute; and requiring additional compensation storage of 90,000,000 cubic feet.

In 1868 a further supply of spring water was brought from Crosswood also on the north side of the Pentland hills and 20 miles from Edinburgh, making an addition of 125 cubic feet a minute, and requiring a compensation reservoir of about 28,000,000 cubic feet, thus making a total storage of 292,000,000 cubic feet, and a total town supply of about 900 cubic feet a minute, or 8,100,000 gallons a day. The cost of the works up to this time was about £435,000.

The Moorfoot scheme, which has just been introduced, will double the former supply; but esent about 1400 cubic feet a minute, equal to about 12,600,000 gallons a day, from ources is found sufficient. The works are from 14 to 17 miles south from Edinburgh, here are two store reservoirs having a capacity of 312,000,000 cubic feet, and two pensation reservoirs, viz., one of 44,000,000 and one of 48,000,000, the latter not yet tructed. Dalkeith and Musselburgh and other neighbouring villages are being supplied the Edinburgh works.

Leicester is supplied with water from two sources, viz., Thornton and Cropstone. The a of the watersheds consists chiefly of slate. The storage reservoir at Thornton miles from Leicester) contains about 273,000,000 gallons. The storage reservoir at stone (five miles from Leicester) contains 500,000,000 gallons. The water is filtered. n Thornton it is sent by gravitation in pipes. At Cropstone, after filtration, the water is ped into service reservoirs, from which the town is supplied by gravitation. The daily umption is about 3,000,000 gallons, of which half comes from Thornton.

Manchester.—The water used for the supply of Manchester is collected from rea of drainage ground of 19,300 statute acres, at and near Woodhead, a distance of t 18½ miles from the centre of Manchester. There are 10 reservoirs extending een the one at Woodhead which is the second largest and furthest from Manchester, the one at Gorton which is the nearest to (about four miles from) Manchester. These rvoirs vary in depth from 20 to 72 feet, and hold from 53,000,000 to 1,474,000,000 gallons. whole of the reservoirs together hold 4,544,000,000 gallons, and one reservoir is in se of construction at Denton, which is calculated to hold 1,860,000,000 gallons. highest reservoir—which is the one at Woodhead—is 650 feet above the level of the nd at the Manchester Exchange; and the lowest, at Gorton, is 125 feet above that level. average quantity of water supplied per day during the year 1880 was 17,998,758 ns. The drainage area at Woodhead from which the water is collected is formed of ower millstone grit, also called the "Kinder Scout grit." These beds are interlaid shale beds, and the flat topped summits of the hills are largely covered with peat, which, ever, does not extend to the slopes of the valleys.

Newcastle and Gateshead.—The supply is obtained from reservoirs at Whittle Dean, miles distant from Newcastle-upon-Tyne, and at Hallington 22 miles distant. The city of these reservoirs is 1,200,000,000 gallons, and the water is obtained from ttleburn, Pont, Fair Spring, Mootlawburn, Hallowell, Smallburn, and Hallington h, and Eastburns, the total drainage area of these streams being 17,000 acres, chiefly ure land. The reservoirs at Hallington and Whittle Dean are connected by an open duct and tunnel, 10 miles in length. The water is conveyed by an open aqueduct and el to filter beds at Throckley, five miles from the town, and is thence distributed by nch and 24-inch metal pipes. The supply is by gravitation to a height of about 200 the higher portions of Newcastle being supplied from a reservoir at Fenham into h the water is pumped from a service reservoir at Benwell, while the higher portions ateshead are supplied from a reservoir at Carr's Hill, to which the water is raised a pumping station on Windmill Hills. There is also a pumping station on the river e at North Wylam, from which a supply can be obtained for manufacturing purposes by a rate line of pipes. In addition to these works two reservoirs are being constructed on

SOCIETY OF PUBLIC ANALYSTS.

Analyses of English Public Water Supplies in March, 1881. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine.	Phosphoric Acid.	Nitrogen as Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in 2 mins. at 80° Fahr.	Oxygen, Absorbed in 4 hours at 80° Fahr.	Hardness, Clark's Scale, in degrees. Before Boiling.	Hardness, Clark's Scale, in degrees. After Boiling.	Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
Kent Co.	c. pale blue	none	1·91	traces	·3500	·0016	0033	none	none	14·8°	4·2°	32·80	satisfactory	Wigner & Harland.
New River	c. f. yellow	none	1·10	traces	·2270	·0028	·0049	·0014	·0973	14·9°	5·0°	21·42	satisfactory	B. Dyer.
East London ..	c. greenh. yellow	none	1·14	traces	·2700	·0023	·0090	none	·0600	17·0°	7·7°	21·70	satisfactory	Wigner & Harland.
Southwark & Vauxhall ..	s. yellow	none	1·24	trace	·1160	·0012	·0070	·(022	·1100	17·0°	5·5°	21·28	v. s. mineral deposit	J. Muter.
West Middlesex	f. yellow.	none	·98	traces	·1740	·0003	·0030	·0030	·0920	14·8°	4·2°	20·82	satisfactory	O. Hehner.
Grand Junction	pale yellow	none	1·26	traces	·1768	·0011	·0061	·0084	·1135	14·8°	4·8°	20·00	satisfactory	A. Wynter-Blyth.
Lambeth	yellowish	none	1·24	trace	·0980	·0002	·0092	·0067	·1142	15·0°	5·5°	21·56	mnl. mtr. few mvg. orgms.	J. Muter.
Chelsea	greenish yellow	none	1·20	traces	·5300	none	·0050	·0100	·0730	14·0°	3·5°	21·00	satisfactory	A. Dupré.
Birmingham ..	f. yellow green	none	·49	traces	·2540	·0014		·0090	·0470	10·7°	6·3°	19·07	satisfactory	A. Hill.
Bradford	peaty yel. opaqe	none	·70	none	none	none	·0042	·0260	·2300	4·2°	3·9°	7·30	satisfactory	F. M. Rimmington.
Brighton	c. p. green blue	none	2·27	traces	·3000	none	·0030	none	none	12·2°	4·4°	24·80	satisfactory	Wigner & Harland.
Bristol	f. green	none	·90	none	·0520	·0005	·0024	·0035	·0490	15·9°	1·5°	22·80	sand, &c.	F. W. Stoddart.
Cambridge	pale blue	none	1·52	h. traces	·4600	·0020	·0024	none	·0014	17·8°	5·5°	24·50	satisfactory	J. West-Knights.
Canterbury	c. pale blue	none	1·47	none	·3290	·0005	·0007	·0050	·0290	7·0°	4·7°	11·76	v. s. mineral matter	S. Harvey.
Coventry	s. turbid grnish.	none	1·12	none	·1650	·0007	·0042	none	·0410	22·1°	7·1°	27·44	s. clay	H. Swete.
Croydon	brght. colourless	none	1·19	trace	·2510	·0035	·0030	none	·0200	15·5°	7·5°	27·40	veget. matter and sand	C. Heisch.
*Croydon	f. greenish	none	1·19	none	·6200	·0010	·0010	none	·0072	15·5°	6·5°	23·0	sand, vegetable fibre	C. Heisch.
Derby	v. good	none	·85	none	·2219	trace	none	trace	·0154	13·2°	5·9°	18·20	satisfactory	L. Archbutt.
Doncaster	faint green	none	1·00	none	traces	·0011	·0070	none	·1270	13·0°	9·0°	14·84		A. H. Allen.
Droitwich	blue	none	2·46	none	·2882	·0070	·0350	·0012	·0312	38·2°	5·1°	43·68	satisfactory	H. Swete.
Dublin	s. yellow	none	·99	trace	trace	·0015	·0080	none	·0550	1·3°	1·0°	4·78	veg. debris and infusoria	C. A. Cameron.
Dudley	grnsh. blue tur.	none	1·57	h. trace	·4030	·0014	·0042	·0120	·1210	17·0°	6·8°	26·04	s. vegetable debris	H. Swete.
Edinburgh	f. yellow tinge	none	·72	none	f. trace	·0016	·0048	·0120	·1142	5·7°	3·7°	7·76	satisfactory	J. Falconer King.
Exeter	f. yellow	none	·91	trace	·1808	·0018	·0026		·0272	2·9°	2·9°	7·00		F. P. Perkins.
Grantham	p. blue	none	1·08	traces	·7330	·0006	·0014	none	·0172	14·9°	5·5°	23·04	diatoms and ferric oxide	A. Ashby.
Huddersfield ..	brnsh. yel. turb.	slight	·60	trace	none	·0070	·0080	·0100	·0274	2·0°	2·0°	5·70	peaty mttr. movg. orgsm	G. Jarmain.
Hull	good	none	1·33	trace	·2430	·0038	·0031	·0020	·0200	15·4°	3·2°	19·70	satisfactory	J. Baynes.
King's Lynn ..	dirty yellow opaque	deyd. veget. matter	1·79	h. traces	·6382	·0036	·0077	·0272	·1686	15·9°	5·1°	24·85	bacteria diatoms	W. Johnstone.
Leeds	light brown	none	·49	traces	none	·0005	·0030	·0140	·1204	4·0°	2·9°	5·04	peaty matter	T. Fairley.
Leicester	yellowish	none	1·12	traces	·1550	·0004	·0140	·0040	·1625	8·0°	4·2°	14·62	confervæ dmids. veg. deb.	W. L. Emmerson.

* One sample is from the Upper and one from the Lower part of the town.

SOCIETY OF PUBLIC ANALYSTS.

Analyses of English Public Water Supplies in March, 1891. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine.	Phosphoric Acid.	Nitrogen as Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen Absorbed in 2 mins. at 80° Fahr.	Oxygen Absorbed in 4 hours at 80° Fahr.	Hardness, Clark's Scale, in degrees. Before Boiling.	Hardness, After Boiling.	Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
Liverpool	yellow brown	peaty	1·22	traces	·0930	·0008	·0033	·0084	·1400	5·2°	5·0°	9·52	satisfactory	A. Smetham.
Llandrindod ..	blue	none	·82	traces	·0085	none	·0014	·0008	·0125	7·5°	3·0°	11·48	satisfactory	H. Swete.
Maidstone—														
Wtr. Company	v. turbid	none	2·50	traces	1·3520	none	·0035	·0056	·0618	16·1°	6·4°	34·37	satisfactory	M. A. Adams.
Public Conduit	c. colourless	none	2·60	traces	1·4230	none	·0021	·0028	·0196	17·9°	6·7°	37·41	satisfactory	M. A. Adams.
Manchester....	s. turbid f. yelw.	none	·61	none	none	·0027	·0038	·0107	·0860	1·3°	1·2°	4·69	s. mineral	W. Thomson.
Newcastle-on-Tyne......	s. turbid yellow	none	·91	trace	·0560	·0010	·0080	·0060	·1040	15·2°	5·5°	19·60	satisfactory	J. Pattinson.
Northampton..	blue	none	5·50	trace	·0160	·0014	·0049	·0005	·0350	9·7°	1.2°	44·40	satisfactory	H. Swete.
Norwich	p. grnsh. yellow	none	1·80	traces	·0353	traces	·0064	·0440	·1260	15·5°	4·0°	17·80	satisfactory	W. G. Crook.
Nottingham ..	p. blu. grn. s. op.	slight	1·62	traces	·4580	·0018	·0015	none	none	13·5°	9·6°	17·8	veg. debris, mycelium	Wigner & Harland.
Oldham	p. yelw. s. turbd.	none	·82	none	·0122	·0125	·0029	·0170	·1000	3·8°	3·6°	7·41	vegetable debris, sand	C. Estcourt.
Plymouth	grnish. grey s. turbid	veget. mttr.	·88	none	·0480	·0010	·0114	none	·0580	4·0°	4·0°	4·60	vegetable debris	R. Oxland.
Portsmouth ..	turbid	none	1·19	trace	·2430	·0010	·0042	·0065	·0320	15·7°	4·5°	18·93	vegetable debris, diatoms, infusoria	W. J. Sykes.
Reading	clear	none	1·00	none	·1200	·0007	·0042	·0070	·0428	14·3°	4·2°	18·20	satisfactory	J. Shea.
Rugby	clear	none	1·60	trace	·4270	·0056	·0084	·0014	·0070	9·8°	9·3°	18·20	a little oxide of iron	A. P. Smith.
Salford	c. s. yellow	none	·80	none	none	·0014	·0035	·0036	·0860	4·0°	3·0°	6·00	satisfactory	J. Carter Bell.
Sevenoaks	c. colourless	none	1.31	trace	·3150	·0014	·0007	·0028	·0101	15·0°	3·9°	19·88	satisfactory	B. Dyer.
Sheffield	brown turbid	none	·50	none	none	·0028	·0049	none	·0750	4·5°	4·5°	5·67		A. H. Allen.
Shrewsbury ..	c. colourless	none	1·31	trace	·4700	·0010	·0040	none	none	21·8°	5·2°	25·00	satisfactory	T. P. Blunt.
Southampton..	f. yellow turbid	none	·99	trace	·1528	·0029	·0138	·0091	·0840	12·5°	4·5°	18·76	veg. deb. dia. desm., &c.	A. Angell.
Stockport	v. s. turbid	none	·88	none	·0276	·0004	·0042	·0010	none	4·2°	3·5°	6·00	satisfactory	C. Estcourt.
Stourbridge ..	blue	none	2·26	trace	·2470	·0028	·0014	·0020	·0725	17·1°	6·1°	31·92	satisfactory	H. Swete.
Stourport	blue green	none	1·13	trace	·0820	·0042	·0014	·0050	·0760	7·4°	1·7°	10·83	sand and clay	H. Swete.
Sunderland....	c. f. blue	none	1·90	trace	·2500	none	·0021	·0050	none	9·6°	3·7°	25·20	vegetable debris	H. J. Yeld.
Swansea	c. yellow	none	1·00	trace	none	·0010	·0042	·0020	·0040	2·5°	2·5°	3·50	satisfactory	W. Morgan.
Warwick	greenish	none	1·19	traces	·3460	·0014	·0028	·0070	·0193	21·4°	12·7°	23·80	satisfactory	A. Bostock Hill.
Whitehaven ..	f. green	none	·37	none	·0138	none	·0021	none	·0030	·4°	·4°	2·20	vegetable debris, diatoms	A. Kitchin.
Wolverhampton	v. turbid	none	1·29	h. trace	·1483	none	·0063	·0054	·1156	12·0°	6·2°	19·88	amorphous veg. deb. amœbæ. diatoms, &c.	E. W. T. Jones.
Worcester	y. brown	slight	1·73	trace	·2190	·0014	·0091	·0280	·1680	17·1°	6·1°	23·52	vegetable debris, sand and clay	H. Swete.

Abbreviations:—c., clear; f., faint; h., heavy; p., pale; v. h., very heavy; v. s., very slight.

ADDENDUM.—In the NORWICH Water in the March table the Oxygen absorbed in 2 minutes was omitted; it should have been ·0029.

SOCIETY OF PUBLIC ANALYSTS.

Analyses of the Water from the seven deep Chalk Wells of the Kent Water Company. All samples drawn in March, 1881, and furnished by the Company. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine.	Phosphoric Acid.	Nitrogen as Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in 2 mins. at 80° Fahr.	Oxygen, Absorbed in 4 hours at 80° Fahr.	Hardness, Clark's Scale, in degrees. Before Boiling.	Hardness, Clark's Scale, in degrees. After Boiling.	Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
Bath	c. pale blue	none	1·77	traces	·4200	·0003	·0013	none	·0160	20·8°	5·4°	28·80	satisfactory	Wigner & Harland.
Crayford	c. pale blue	none	1·63	h. traces	·3710	·0020	·0025	none	·0100	17·9°	5·7°	25·80	satisfactory	
Garden Engine	c. pale blue	none	1 77	traces	·4800	·0009	·0018	none	·0210	23·4°	7·4°	33·40	satisfactory	
Orpington	c. pale blue	none	1·20	traces	·4280	·0015	·0025	none	·0080	17·9°	4·0°	22·20	satisfactory	
Plumstead	c. pale blue	none	2·84	none	·4340	traces	·0009	none	·0200	23·3°	9·3°	35·20	satisfactory	
Shortlands	c. pale blue	none	1·20	none	·3080	traces	·0045	none	·0120	17·0°	3·2°	22·00	satisfactory	
Twinswell	c. pale blue	none	1·77	none	·5390	·0039	·0014	none	·0160	21·3°	6·9°	25·40	satisfactory	

NOTE.—Corresponding Tables relating to the supplies of other Companies will be published from month to month as the results can be obtained.

the Swinburn, 24 miles from Newcastle, and are nearly completed; they cover an area of 242 acres and will have storage for 1,100,000,000 gallons, thus bringing the total capacity up to 2,300,060,000 gallons. The works at Swinburn are connected with the reservoir at Hallington by means of a tunnel two miles in length and five feet in diameter. The daily consumption is about 10,000,000 gallons, and the supply constant.

Norwich.—The supply is derived from the river Wensum, which rises at East Rudham and traverses a course of about 40 miles. The filter beds are situate in Heigham, about half a mile from the city, from which it is forced to distributing reservoirs at Lakenham, a height of about 134 feet above the level of the river at Carron Bridge, from whence it can be obtained by gravitation at all parts of the city. The valley through which the river Wensum flows is an agricultural district of about 236 square miles.

Shrewsbury. — The water supply is derived from a spring lying on high ground about two miles from the town and in the midst of fields. Formerly there were nine wells, narrow, and of very ancient construction—they are said to be 300 years old—from which the supply was taken, but a considerable overflow and consequent waste, which much increased with a succession of wet seasons, led to the embanking of the site of the wells, which are now covered by a small lake. The water is conveyed to the town in leaden pipes, upon which it has no action, and is distributed by means of numerous stand-pipes or "conduits," as they are locally termed, placed at short intervals throughout the town.

Mr. J. W. Biggart, of Greenock, has been appointed Public Analyst for the Burgh of Rothesay.

CORRESPONDENCE.

[The Editors are not responsible for the opinions of their Correspondents.]

THE WATER OF PHILADELPHIA, U.S.A.

To the Editor of "The Analyst."

R,—I have watched with much interest the articles on Water Analysis which have from appeared in your journal, and I have been especially pleased by the recently-inaugurated mparative reports. I have ventured to request from the Hon. Sec. of the Society of Public opy of the instructions used, and I shall take pleasure in forwarding to your journal some xaminations of the public water supply of this city, which results may be interesting as a different district. As a preliminary contribution I submit some tests made recently upon water taken from widely separated parts of the city. The greater part of Philadelphia is the Schuylkill river, a slack-water stream which near the city is from 200 to 400 yards ceives no sewage of any consequence for five miles above the intake point. A smaller pplied from the Delaware, a tidal river varying from half-a-mile to one mile in width, and st of the city sewage, but at points below the intake. No system of filtration is adopted, sources of supply mingle at many points. At the time of the analysis both rivers were in a het from melting ice, and were turbid from minute particles. The total solid residue is sual. All the figures are in grains to the imperial gallon.

	Schuylkill.		Delaware.
2ft. tube	Dirty yellow.	..	Dirty yellow.
t 100°F.	None.	..	Slightly musty.
olids	6·12	..	4·2
e	0·33	..	0·33
required at 60°F. in three hours..	0·084	..	0·168
nt	Fine siliceous matter with vegetable *debris* and ciliated animalculæ.	..	Fine siliceous matter with animalculæ, such as are found in decomposing vegetable matter.

Yours truly,

HENRY LEFFMAN, M.D.

ut Street, Philadelphia, March 1st, 1881.

To the Editor of "The Analyst."

n communicating the monthly analyses of public water supplies to your valuable paper, be advisable for the analysts to state the *date* on which the samples were taken?

son for asking this is, that we who live in Salford believe that the water supplied to us (from ster Corporation Water Works) is the same as that distributed throughout Manchester; but, ng the analyses of Manchester and Salford water for January and February, I find that former shows more chlorine and free and albuminoid ammonia, and less oxygen absorbed, than in February, in the Salford water this is reversed, the February supply containing more l free and albuminoid ammonia, and absorbing less oxygen than that analysed in January. refore appear that the samples were taken at different parts of the month, and if in the case dates of collection had been stated, such a variation in the same water supply might have al interest to your readers.

Yours faithfully,

PERCY J. WINSER.

roughton, Manchester, March 21, 1881.

THE MANUFACTURE OF WOOD ALCOHOL.

wood alcohol, or pyroligneous acid, together with impure acetic acid, wood tar, nd water, forms the first products of the dry distillation of wood. The wood ployed for this purpose, and affording the best yield of these commercial products birch, after which come in their respective order of values, beech, elder and oak. ss of distillation is as follows: The wood, carefully seasoned and thoroughly f its bark, is placed in suitable charges into iron retorts, similar in shape to those al gas factories, *but much larger*, and subject to a heat varying from 400° to 500°

Fahrenheit, in furnaces so constructed that the fire surrounds the retort and insures a uniform temperature on all sides. The length of time required for this baking process varies according to the charge of wood placed in the retort, but is generally from six to eight hours. The more slowly the process is conducted, however, the larger is the percentage of wood alcohol afforded and the smaller of acetic acid, as a quick fire destroys the alcohol by evaporation. The best seasoned wood yields the greater percentage of all the commercial products. After the first distillation the liquor expelled from the wood is run off into tubs or evaporating pans, and allowed to stand until the tarry matter rises to the top, which is then skimmed off. The acetic acid is then neutralized by lime, separating it from the pyroligneous acid and forming the commercial acetate of lime. If the two acids are first distilled over, the grey acetate of lime is produced. After the acetic acid is precipitated and neutralized by the lime, the pyroligneous acid, or pyroxylic spirits, is distilled again; the wood alcohol, in a crude, impure form, is evolved from it. Another distillation concentrates it still further, after which it is ready to be sent to the rectifier. The rectifying process frees it from all impurities of a tarry nature and removes all traces of acetic acid, as well as much of the characteristic odour caused by the presence of different volatile substances. It is a secret carefully guarded by the rectifiers, and very few are acquainted with the character or the proportions of the chemicals employed in the process, though the work is done in a still of ordinary appearance.

In one hundred parts of birch wood, properly prepared by seasoning, &c., are found about the following percentages of commercial products: Crude Acetic Acid (containing 9·9 per cent. of glacial acetic acid), 44·5; Tar, 8·6; Charcoal, 24·2; Wood Alcohol, from ·5 to 1·2; Water, from 21·5 to 22·2.

Most of the acetic acid, of all grades, used for manufacturing or pharmaceutical purposes, is made in this way, from the ordinary crude commercial to the concentrated, chemically pure, and glacial acetic acids of the Pharmacopœia. It is also used in the manufacture of the brown and white sugar of lead.—*Oil and Drug News.*

LAW REPORTS.

Heavy Fine for Selling Adulterated Milk:—

At the Huddersfield Police Court, on March 7th, 1881, James Dearnley, a milk dealer, living at Almondbury Bank, was charged on the information of Mr. Kirk, the sanitary inspector, with selling a pint of milk which was not of the quality demanded by the purchaser.—He pleaded guilty.—Mr. Kirk stated that on the 22nd Feb. he asked Mr. Councillor B. Littlewood to purchase for him from the defendant a pint of new milk, which he did, and for which he gave him 1½d. Witness induced the defendant eventually to take a part of the milk, which he was told had been bought in order that it might be analysed by the Borough Analyst. The milk had been analysed, and Mr. Jarmain had given a certificate showing that of butter fat there was 0·86 per cent.; of solids other than fat, 10·2; and of water, 88·94; thus the milk had been impoverished by the removal of 72 per cent. of its butter fat.—The defendant said he sold the milk as he got it; and it was old, and not new milk. Any one buying milk at 1½d. a pint would know that it was not new.—Mr. Kirk said he heard Mr. Littlewood ask if the milk was new, and also heard the defendant say it was.—Mr. Littlewood corroborated this statement.—Defendant denied it, and said he asked him how he could expect to have new milk at 1½d. a pint.—Mr. Kirk told the Bench that defendant said that after the purchase was completed.—Defendant said the price of new milk was 2d. a pint, and in his eagerness to catch him Mr Littlewood asked for a halfpenny out of the 2d., and he gave it to him.—Mr. Littlewood said he asked for the halfpenny because he was informed that new milk was only 3d. a quart.—It was stated that the defendant had been fined twice for a similar offence, once £5 and once £10, but fining seemed to have no deterrent influence on him.—The defendant said he was about to give up the milk business, and he asked the Bench to deal leniently with him.—The Bench said he would have to pay a fine of £15 and the expenses.—Defendant: Is that the lowest you can take?—Mr. Mills (the magistrate's clerk): Can you pay?—Defendant: Yes, sir.

... before the Mayor (Mr. G. Curtis) and Mr. F. Millns, ... High Street, was summoned by Mr. Jno. Hutchins, ...ling brandy adulterated to the prejudice of the purchaser. Mr. Travers was for the defence. Mr. Dickenson said it ... penalty might be inflicted. The evidence showed that ... of Sturminster, the Borough Analyst, the brandy was 52½ ... than the law allows it to be sold at. For the defence the ... asked the inspector if he would have sixpenny or shilling ... Bench: The price could make no difference in the con... The only question raised for the defence was whether the ... laid down in the Act at the time he made the purchase, but ... fine of 20s. and costs.

... Court, Mr. John Ball, provision dealer, Dudley Street, ... Food and Drugs Act, for his wife, as his agent, having sold ... nature, substance, and quality of the article demanded, but ...nce appeared to prosecute on behalf of the Sanitary Committee ... the defendant. The first witness called was Samuel Blanton, ... the Sale of Food and Drugs Act. On the 16th ult. he went ...rs. Ball, defendant's wife, whom he asked for a pound of roll ... roll, and, paying her, witness told her that he should forward ...ards stated, "It is butterine, and I told you as I went to the ... In reply to Mr. Rhodes, witness said he did not know that fresh ... 10d. a pound; neither did he know that he had ever bought ... did not hear Mrs. Ball say the article was butterine as she went to ..., the County and Borough Analyst, said the sample that had been ...cent. of genuine butter fat, the rest being animal fat. It was an ...tured under the name of butterine and other names. There was, ... health in such a commodity if pure fat was used. Mr. Rhodes said ... was oath against oath, and the defendant's wife was quite as respectable ... would contradict the evidence of the inspector, and, as a doubt would ...se be dismissed. Mrs. Ball was afterwards called as a witness for the ... the inspector asked for butter, she told him "that it was butterine." The ... said the words, she said them in such a way as to be inaudible to the ... the case proved, and fined the defendant 5s. and costs.

...ilway Station:—

...e Rutzen gave his decision in the matter of John Hall, a farmer, of Coventry, for ... station which was found on analysis by the Public Analyst of St. Pancras to ... before him the summons was dismissed on the ground that the Inspector, in ... not complied with the Act. The Vestry went to the Court of Queen's Bench, ... was reversed, and the case remitted back to the magistrate to impose a penalty. ...ully reported in our previous issues.* Mr. De Rutzen now inflicted a fine of 40s.

...liam Norris, milkseller and dairyman, Peter Street, was charged under a summons ...id sell, to the prejudice of Joseph Bruce, the purchaser thereof, as an article of food, ...hich was a mixed fluid and not of the nature and substance and quality demanded. ... prosecuted, and Mr. Tonkin appeared for the defendant. Mr. Bruce, inspector, in ... Bristol and West of England Milksellers' and Dairymen's Association, said he went to ... in Peter Street, and asked for a pint of milk. A man named Backhouse, who was behind ...applied him with the quantity required, and witness then informed him that he intended ...lysed, and gave him a portion of the milk he had purchased, retaining the other himself. ...s took the milk to the Public Analyst (Mr. Stoddart), and it was found to contain 10 per ...er. A document from Mr. Stoddart was put in by Mr. Wansborough, certifying that the ...tion contained 10 per cent. of water. Mr. Tonkin, on behalf of his client, denied any ad...ater in the milk, and pointed out that the sample was demanded at five o'clock in the after...as taken from a can of milk which had been standing in the shop since the morning, where... might have deteriorated. He called Mr. Norris, who stated he was a dairy farmer, ...

* See Page 11 of this Volume.

at Whitchurch, and carrying on business in Peter Street as a milkseller. He always superintended the sending away of the milk himself, and was most careful that it went away in a pure state. He served the Grand Hotel, Messrs. Dunlop and Co., and other large firms, and had never had any complaint. Richard Backhouse, in the employ of the defendant, said that the milk given to Mr. Bruce was the identical milk supplied to him in the morning by Mr. Norris. He had not put any water in the milk, and it had been under his supervision all the day. The Magistrates, after a short consultation, said that they had carefully considered the case, and they were of opinion that water had been added. With regard to Mr. Norris, they did not think he was aware that water had been added to the milk, but they had sufficient confidence in their Public Analyst to take his word for it. Mr. Norris, as owner of the milk, was of course responsible, and they should inflict a penalty of 40s. and costs.

Was it Sold as Butter or Butterine?—

Samuel Nelson, provision dealer, Folly Hall, Huddersfield, was charged with selling 1lb. of butter not of the quality required by the purchaser. Mr. Kirk, sanitary inspector, prosecuted, and said the defendant had a stall in the Market. On the 24th ult. he requested William Beaumont (the witness in the last case) to purchase for him, from the defendant's shop, half a pound of cheese, one pound of bacon, and one pound of butter. Beaumont made the purchases; and afterwards he (Mr. Kirk) went into the shop and said that the butter was bought for analysis, and asked the defendant's wife if she desired to retain a part of it. She said she had sold it for butterine, but he reminded her that she had told Beaumont that it was good butter. Mr. Nelson then entered the shop, and said "Yes, she did sell it as butterine." Witness asked him who he was, and he said he was the woman's husband. He then inquired of him how he knew that it was sold for butterine when he was not in the shop at the time. The butter was submitted to analysis, and the report of Mr. George Jarmain stated that the sample was made up of fat other than butter fat—it was butterine, and had undergone no change in its composition. Beaumont gave corroborative evidence. He said Mrs. Nelson told him that it was good butter, but when he told her it was for Mr. Kirk she said "I have sold you that for butterine." Mr. J. D. Liversedge, a clerk in the sanitary office, said on Christmas Eve he was near the defendant's shop, and heard what took place. Beaumont obtained the cheese and bacon, and then asked for the butter. When she was wrapping it up she told him (Beaumont) that it was very good butter; but when told that it was for Mr. Kirk, she said she had sold it for butterine. Mrs. Nelson asked how she could sell it for butter when the word "butterine" was on the box from which she took it? She said she pointed this out to Mr. Kirk, who said it was not sufficient, and he now told the Bench that the word was not in continuation, but that the termination "ine" was in small letters, and underneath the word "butter." He asserted that it was a piece of deception; but this was denied by the defendant, who called John Kershaw, a neighbour, as a witness. He said that on the day in question he was called by the defendant to his shop, and asked him what the letters on the box spelt, and he said "butterine."—The Mayor said the Bench were of opinion that the case was proved, and the defendant would be fined £5 and costs.

RECENT CHEMICAL PATENTS.

The following specifications have been recently published, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

No. 1880	Name of Patentee.	Title of Patent.	Price.
2666	G. W. Davey	Distillation of Coal Tar	6d.
2914	R Neale	Chemicals for Purifying Vitiated Air	6d.
3170	Ditto	Application of Chemicals for Purifying Vitiated Air	2d.
3025	P. Jensen	Electric Lighting	6d.
3155	W. E. and J. W. Hazlehurst	Manufacture of Artificial Manure	2d.
3201	F. J. Cheesebrough	Manufacture of Aqua Ammonia	6d.
3218	J. Imray	Distilling Hydrocarbons from Coal Shale, &c.	2d.
3248	A. Specht	Carburetting Coal Gases	4d.
3264	H. Springmann	Application of Gravel, &c., to the Refining of Sugar	4d.
3330	J. H. Johnson	Preparation of Cinnamic Acid	4d.
3340	G. Wischin	Distillating of Anthracene from Coal Tar	2d.
3361	A. Sauvée	Refining Sugar	2d.
3366	W. R. Lake	Obtaining Starchy and Glutinous Matters from Indian Corn or Maize	

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; Journal of Applied Science; The Boston Journal of Chemistry; The Provisioner; The Practitioner; New Remedies; Proceedings of the American Chemical Society; Le Practicien; The Inventors' Record; New York Public Health; The Scientific American; Society of Arts Journal; Sanitary Engineer of New York; The Cowkeeper and Dairyman's Journal; The Chemists' Journal; Oil and Drug News; The Textile Record of America; Sugar Cane; British Association Report of Annual Meeting at Swansea (Swansea, Tweney & Co.); Milk and its Analysis, Gibbons (Manchester, Ireland & Co.); Country Brewers' Gazette.

THE ANALYST.

MAY, 1881.

SOCIETY OF PUBLIC ANALYSTS.

The Meeting appointed to take place on the 13th April was postponed on account of the Easter holidays, and will now be held at Burlington House on Wednesday, May 11th, at 8 o'clock. Among the papers to be read are one by Dr. Alfred Hill, on Some Tea Analyses, and two by Mr. Allen, on the Isolation of Strychnine, and the Assay of Oils.

RESULTS OF ANALYSES OF THE MILK OF FORTY-TWO COWS.

By Charles A. Cameron, M.D., Professor of Chemistry, Royal College of Surgeons; Lecturer on Chemistry and Geology, Government Agricultural Institution, Glasnevin.

During the winter quarter of 1880 analyses were made of the milk of forty-two cows kept at the Government Agricultural Institution, Glasnevin, Co. Dublin.

The morning's milk and the evening's milk of each cow were each analysed once; and an examination of the mixed milk of the forty-two cows was also made on the 11th December, 1880.

The cows, it may be mentioned, were good animals: they had from one to three crosses of the shorthorn breed. They were in the house during the period of the experiments. Their food consisted of a daily allowance of from 8 to 10 stones of pulped mangolds and turnips, and exhausted grain from the brewery, together with from ½ to 1¼ stones of hay. They were, therefore, liberally fed.

The results obtained are sufficiently numerous to warrant some conclusions being deduced from them in reference to the average composition of cows' milk and the limits of variability in the proportions of the different ingredients. Some conclusions may also be drawn, but with greater reserve, from them as to the influence of age and period of lactation upon the composition of the milk.

INFLUENCE OF AGE UPON THE QUALITY OF THE MILK.

The ages of the cows ranged from four years to nine years inclusive. If we take two groups—(1st) those aged four years and five years, and (2nd) those aged eight years and nine years—we shall find a great difference in favour of the milk of the latter, both in quantity and quality.

The eighteen cows composing the first group were on the average giving milk during three months: the average yield from each cow was 9¾ quarts—their morning's milk contained on the average 12·97 per cent. of solid matter, and their evening's milk 13·58 per cent. of solid matter. On the other hand, twelve cows, aged eight years and nine years inclusive, on the average in their fifth month of lactation yielded 10½ quarts of milk daily,

containing in the morning 13·39 per cent. of solid matters, and in the evening 13·96 per cent. The richest specimen of milk, save one, was yielded by a cow eight years old, and in the tenth month of lactation. She only, however, gave 6 quarts of milk the day on which a specimen of it was taken for analysis. There were only four cows aged four years, and the average composition of their milk was—

Solids	12·245 per cent.
Water	87·755 „
	100·000

Their average yield of milk was $11\frac{1}{4}$ quarts.

The superiority of the old cows in giving more and better milk may in part be due to the fact that it is only good milch cows that are, as a rule, kept in the dairy several years; the young cows that give poor milk are often put into the stall to fatten.

INFLUENCE OF PERIOD OF LACTATION ON THE QUALITY OF MILK.

The belief that milk becomes deteriorated in quality towards the end of lactation is not supported by the results obtained by these experiments, so far as they go. Eleven of the forty-two cows were giving milk from eight to ten months; the average yield of their milk was $6\frac{4}{5}$ quarts, which was much below the average yield of all the forty-two cows. The total solid matter in their morning's milk was 13·57 per cent., and in their evening's milk 13·96 per cent.

At an advanced period of lactation the milk becomes scanty in quantity, but its quality—at least, as shown in the cases of the eleven cows in question—becomes, on the whole, improved.

Six cows were giving milk for periods less than one month. They yielded 13 quarts daily each on the average. The solid matters in their morning's milk were 12·70 per cent., and in their evening's milk 13 21 per cent.

Eleven of the cows were giving milk from one to two months. They furnished on the average $11\frac{1}{2}$ quarts per diem. The solid matters in their morning's milk amounted to 13·46 per cent., and in their evening's milk to 14·12 per cent.

Five of the cows were giving milk for four months. Their yield was on the average $10\frac{1}{2}$ quarts daily. The total solids in the morning's milk amounted to 12·196 per cent., and in the evening's milk to 13·456 per cent.

In the following table the amount of solids in each case is shown:—

Cows giving milk.	Qts. yielded per day.	Per cent. of solids in morning's milk.	Per cent. of solids in evening's milk.
Less than one month	.. 13 ..	.. 12·700 ..	.. 13·210
During one month to two months	.. $11\frac{1}{2}$ ..	.. 13·460 ..	.. 14·120
During four months	.. $10\frac{1}{2}$ ..	.. 12·196 ..	.. 13·456
During eight to ten months inclusive ..	$6\frac{4}{5}$ ..	.. 13·570 ..	.. 13·960

DIFFERENCE BETWEEN THE QUANTITIES YIELDED IN THE MORNING AND EVENING.

In every instance the quantity of milk yielded in the morning exceeded the proportion furnished in the evening. In two instances the morning's supply was three times more abundant, and in very many cases twice as plentiful. About eight hours intervened between the two milkings.

SUPERIORITY OF THE EVENING'S MILK.

Thirty out of the forty-two cows gave richer milk in the evening than in the morning, and eleven cows gave richer milk in the morning than in the evening, whilst the remaining

cow's milk was equally good at both milkings. The average amount of solids in the morning's milk was 13·20, and the evening's milk 13·74—a difference of 0·54 per cent. The increase in the amount of solid matters in the evening's milk was due chiefly to the larger amount of fats contained in the latter. The amount was 4·22 or 0·4 per cent. over the proportion (3·82 per cent.) found in the morning's milk. In the case of the mixed milk of the forty-two cows, that yielded in the evening was richer by ·56 per cent. of solid matters, including 0·44 per cent. of fats.

AVERAGE COMPOSITION OF MILK.

The results of the analyses of the milk of these forty-two cows show that the mixed milk of well-fed cows in houses, in the last quarter of the year, contains, when poorest—*i.e.*, in the morning—13·90 per. cent. of solid matter, including 4·20 per cent. of fats. On the 2nd November, the mixed milk of eight cows, which happened to be in the same house, was analysed. One hundred parts contained—

Total solid matters	13·90 per cent.
Solids *minus* fats	9·75 „
Fats	4·15 „
Ash	0·72 „

The Society of Public Analysts of Great Britain and Ireland have adopted, as a standard for the poorest pure milk, 9 per cent. of solids *minus* fats and 2·5 per cent. of fats—a total of 11·5 per cent. of solids. There is little doubt that milk containing less than 11·5 per cent. of solids is watered or skimmed. Still, the results of the analyses of the milk of the Glasnevin cows prove that the milk of an individual cow may contain less than 9·5 per cent. of solids *minus* fats. In twenty-five instances the solids *minus* fats were less than 9 per cent. So far as house-fed cattle in Ireland are concerned, 9 per cent. of solids *minus* fats should be reduced to 8·5 per cent. At the same time, if the milk be the mixed product of several cows, say eight and upwards, then 9 per cent. would be a fair proportion to expect. In the mixed milk (morning's) of the forty-two cows the solid matter *minus* fats was 0·7 per cent. above the standard figure 9, whilst the average of the forty-two analyses of the morning's milk gave only an excess of 0·38 per cent. above the standard proportion.

With respect to the amount of fats, I think 2·5 per cent. rather low: I am disposed to believe that it should be raised to 2·75. In the morning's milk the maximum amount of fat was 5·40 per cent., and the minimum proportion was 2·88 per cent. In the evening's milk the maximum amount was 6·30 per cent., and the minimum 2·69 per cent. The average percentage of fat in the mixed milk of the cows was 4·20 in the morning's and 4·62 in the evening's. Thus it will be seen that, whilst in twenty-five instances the solids *minus* fats fell below the Society's standard, in no instance did the fats fall so low as the Society's standard.

The percentage of total solid matter in the morning's milk varied from 15·50 to 11·44, and in the evening's milk from 16·80 to 11·50.

The mixed milk of 100 cows kept on the dairy farm of Mr. E. M. Russell, Pery Square, was found to contain at the evening's milking 13·85 per cent of solid, including 4·60 per cent. of fats, and 0·72 per cent. of ash. The solids *minus* fats were 9·25 per cent. The analysis was made in March, 1881.

The percentage of solids *minus* fats varied in the morning's milk from 11·78 to 8·25, and in the evening's milk from 11·30 to 8·27.

The suggestion has often been made that a standard for milk should be defined by statute. Perhaps it would be advisable to institute two standards. One might be for solids *minus* fats 8·5, and for fats 2·7 per cent. Any person selling milk below this quality should not be entitled to any defence on the ground of natural poverty of the milk. Another and general standard might be solids *minus* fats 9 per cent., fats 3 per cent. It would be open to persons charged with having sold milk below this standard to prove that it was procured from a very limited number of cows; or they might demand that the cows should be milked in the presence of a responsible person, and a sample of the milk so obtained analysed.

A milk vendor who was prosecuted for selling milk which I certified was adulterated, protested in court that it was pure, but that it was procured from four cows known to yield a very poor milk. I suggested that the cows should be milked in the presence of an officer of the court, and the milk analysed. I found that it contained 13·20 per cent. of solids, including 3·5 per cent. of fats. The milk was also analysed by the Inland Revenue Chemists, Somerset House, and with identical results. They further stated that it would be necessary to add 22 per cent. of water to it in order to reduce the amount of solids *minus* fats in it, to that present in the alleged adulterated sample which was also analysed at Somerset House.

I think there is the strongest proof that milk on the average contains more than 13 per cent. of solid matters. During the last sixteen years I have examined an immense number of specimens of this liquid, and whenever I was certain that it was pure, I invariably found it to contain more than 12 per cent. of solids. I am quite satisfied that the milk of Dublin dairy herds contains from 13 to 15 per cent. of solids.

METHOD OF ANALYSIS.

10 grammes of the milk were kept in a shallow capsule in the water bath at 212 deg. F. until thoroughly desiccated; the residue showed the amount of total solid matters. The 10 grammes, dried and pulverised, were boiled in about 80 cubic centimetres of ether for several hours, an upright condenser being placed over the flask containing the ether to prevent a waste of the latter. The ether containing the milk fats in solution was filtered (a very small piece of filtering paper being used) into a light tared flask. The ether was distilled off, and the last traces got rid of by passing a current of hot dry air through the flask and condenser. The flask and its fatty contents were then weighed. The amount of the ash was determined by igniting at a low temperature in a platinum dish, the residue obtained by evaporating 10 grammes of the milk to dryness.

It is perhaps, in part, owing to the great care taken to extract every particle of the fat that such high percentages of that ingredient were obtained.

In every instance the amount of solids was determined by two independent experiments. Many of the weighings of the fats and ash were repeated.

SWEDISH LAWS REGULATING THE SALE OF POISONS.

By C. Heisch, F.C.S., F.I.C.

Read before the Society of Public Analysts, on March 16th, 1881.

Having had occasion to examine into the laws affecting the sale of poisons in different countries, I thought it might be of interest to the Society to learn the principal regulations

in force in Sweden (where much pains has been taken in the matter by the Board of Health) without wading through three very verbose Decrees in a language not generally "understanded of the people," but which I am fortunate enough to be able to get translated to any extent.

The 1st Decree bears date January 6th, 1876, and concerns "the Sale of Arsenic and other poisonous matters."

All through arsenic holds a very prominent place, many of the restrictions applying to it alone. Why this should be it is somewhat difficult to understand.

CLAUSE I.

Enacts that white arsenic, or arsenic acid, shall not be made within the Kingdom without the King's permission, and shall only be imported by a pharmaceutical chemist, or by licensed manufacturers, who require this poisonous ingredient.

CLAUSE II.

Section 1 enacts that a pharmaceutist wishing to import arsenic must give notice to the Board of Health, and a manufacturer to the Board of Trade, and obtain a certificate addressed to the Custom House at which the arsenic is to be received, stating where it is to be stored and what quantity the applicant may import, such certificate to be null and void after three months.

Section 2.—Custom House to keep proper record of every importation, and report to Boards of Health and Trade every year.

CLAUSE III.

Only principals or qualified managers of druggists' shops to be allowed to sell arsenic.

CLAUSE IV.

Arsenic not to be sold by pharmaceutist himself, except as follows :—

(a) On a recently issued prescription of a qualified medical man, dentist, or veterinary surgeon. Buyer to give receipt to seller stating what he has bought.

(b) Qualified manager may act in absence of principal.

(c) On a written requisition to a particular druggist, stating quantity and purpose for which required, duly signed. Or arsenic may be delivered to a known scientific chemist, or to a manufacturer who requires it in his business; but either must produce a warrant from a magistrate or a Crown bailiff, not more than a year and a day old. Buyer to sign an undertaking to use all proper precautions in storing the poisons, and not to part with any to anyone. Druggist may refuse to supply if he thinks fit.

Section 2.—Arsenic shall not be sold for destroying rats or vermin or for embalming.

CLAUSE V.

All arsenical preparations delivered according to prescriptions to be officially sealed by the druggist. In all other cases to be in strong glass vessels with proper stoppers, or in strong and securely fastened wooden vessels, sealed by the druggist, and labelled with name of druggist, time of delivery, name of preparation, and the word poison.

CLAUSE VI.

Druggists keeping arsenic to undertake to keep it in such vessels as in V., and under lock and key; no one to have access thereto except druggist himself or his sworn agent.

CLAUSE VII.

Arsenic only to be transported in similar cases, labelled with names of consignor and consignee, quantity, &c.

CLAUSE VIII.

Druggist to keep arsenic book, paged: to be submitted to a magistrate and signed by him before any entry is made, and he (the magistrate) shall state number of pages at date of delivery. Arsenic book to be delivered to magistrate when full, and by him kept 10 years.

CLAUSE IX.

All prescriptions and orders on which arsenic has been sold to be attached to arsenic book and kept with it.

CLAUSE X.

Authorized professional men to inspect arsenic book periodically and report to Board of Trade. Magistrate of county to inspect all stocks of arsenic at least once a year, and compare with books and report result of inspection.

CLAUSE XI.

All persons wishing to manufacture any poisonous article must hold a certificate from one of the Universities, the Medico-Chirurgical Institute, or the Technical School.

CLAUSE XII.

Poisonous articles, other than arsenic, only to be sold by—(*a*) Principals of Drug Stores; (*b*) Pharmaceutical Chemists. All rules for sale of arsenic to apply to other poisons. All scales, weights, scoops, &c., used in weighing or measuring any poison, to be kept for that purpose alone. Poisons to be kept in a separate room to which no one but principal or sworn manager has access.

CLAUSE XVII.

Strychnine or any preparation thereof only to be allowed for killing vermin, under special permit, to be granted by Crown Inspector, if he deem the circumstances to warrant it. Such permit to state all particulars and length of time it may remain in force.

CLAUSE XVIII.

Children's toys not to be painted with poisonous water colours. Colour boxes not to be sold containing poisonous colours unless provided with prominent label stating the fact.

CLAUSE XIX.

No poisonous colours to be used in eatables of any kind. Board of Health to publish list of colours that may be used for this purpose. No leaden moulds or papers prepared with lead to be used by pastrycooks for preparing or wrapping their goods.

CLAUSE XX.

Paper hangings, roller blinds, textile fabrics, artificial flowers, or other goods in water colour, not to contain arsenic. Lamp shades, wafers, stearine or other candles, not to contain arsenic or other poisonous matter.

PENALTIES.

For importing arsenic otherwise than as directed, 200 to 1000 crowns, and forfeiture of goods.

For manufacturing poisonous wares without a license, 100 to 500 crowns.

Any manufacturer having a license infringing any one of the rules, 50 to 500 crowns.

Selling without a license, 100 to 500 crowns.

Infringement of rules for selling, 50 to 500 crowns.

If infringement be made by an apothecary's sworn assistant, master not to be liable.

All other infringement of rules, 25 to 100 crowns.

All Customs' servants, railway officials, &c., to watch over import or transport of poisonous matters, and report same to authorities, or Customs' servants may seize such goods.

Commissioners of Public Health to watch for infringements, and if they see any carelessness in keeping or selling poisons by licensed persons, are to admonish, and, on second offence, report to police.

Any poisons seized to be sealed and kept till it is decided in a court of law what is to be done with them. Notice of seizure to be given to Chief of Police.

Any person being in legal possession of arsenic and wishing to get rid of the responsibility may hand it over to the nearest apothecary, who shall take charge of it as if it were his own, provided the weight does not exceed ten pounds: if above this weight it must be handed to Crown bailiff.

One copy of this Decree, and also of the Proclamation, to be issued by Board of Health, to be accessible at every apothecary's and manufacturer's, or the house of anyone licensed to sell or keep poisons, under penalty of 10 to 50 crowns. Fines to be divided as follows:—One-third to the Crown, two-thirds to Public Prosecutor. If information be given by a private individual then he and Public Prosecutor divide this two-thirds between them.

To take effect after July 1st, 1876.

(To be continued.)

ON THE WORK DONE BY PUBLIC ANALYSTS DURING 1880 UNDER THE SALE OF FOOD AND DRUGS ACTS.

(Compiled from Returns furnished by the Members of the Society of Public Analysts and others).

By G. W. Wigner, Joint Hon. Sec. of the Society of Public Analysts.

The Members of the Society of Public Analysts, and a few of the other Public Analysts who are yet outside the ranks of the Society, have again furnished us with the results of their work in detecting adulteration during the past year, and it is now my duty, for the fifth time, to summarise this work.

The Blue Books, which contain the national returns on the subject, are necessarily delayed until a later period of the year, and they give what, from our point of view, is considered somewhat scanty details in regard to the distribution of the samples in different districts, and in the hands of different analysts. Adulteration is essentially a crime, and as such it is our desire to point it out and show its extent in such a way that the discredit attaching to it shall not be unjustly placed on any particular class of traders, or on any particular district, but that each shall bear the responsibility in proper proportion. These yearly summaries have for this reason been compiled in such a manner as to show in what particular line of business adulteration is most rampant.

The importance of these returns increases each year, because most civilized countries are following the example of England in passing laws for repressing adulteration. No nation has, however, up to the present time, taken any step in advance of us, although several are following closely on our lines.

During this transition stage, exaggerated statements in reference to the prevalence of adulteration, and the small amount of good which has been effected by our English laws,

are being published by persons who have had insufficient practical acquaintance with the subject, and the only way to prevent false inferences being drawn is to take care that accurate and reliable statistics are readily available for those who may need them.

These statistics, unfortunately, prove that our legislation on the subject is not yet perfect, but, on the contrary, that the rate of adulteration prevailing now, although a vast improvement upon the condition of things prior to the passing of our Acts, does not show a continued decrease, and although we may stand better in this respect than some other European countries the amount of fraud disclosed is much greater than should be the case.

Nor is the reason far to seek. The total number of official samples analysed in the year is but little more than one for every two thousand of the population, and probably not more than one sample out of every million articles purchased is submitted to any proper and reliable scientific test. It is no wonder, then, that repression has at present failed to effect all the good it was expected to do, but wonder should rather be expressed that such marked results have already been obtained.

The numbers of returns received by us of samples analysed and reported upon during the last six years have been as follows :—

Year.	Districts.	Samples Examined.	Samples Adulterated.	Percentage Adulterated.
1875-6	109	15989	2895	18·10
1877	127	11943	2371	17·70
1878	168	15107	2505	16·58
1879	212	17574	3032	17·25
1880	237	17919	3132	17·47

Once more, therefore, 1880 follows 1879 in showing an increase in the percentage of adulteration. Since no reason for this is apparent, it will be well, as in previous years, to trace this percentage as it exists in reference to each class of samples.

I will first consider the number of samples purchased by the Inspectors and submitted to the Public Analysts. The total of 17,919 shown in the table necessarily includes waters—not because these are strictly under the Act, but because, in some cases, they become mixed up in the returns. The articles purchased have been divided into various classes, as follows :—

SAMPLES PURCHASED, 1879 AND 1880.

	Numbers.		Percentage.	
	1879.	1880.	1879.	1880.
Milk	6036	7251	36·1	40·40
Butter	969	892	5·7	4·97
Groceries	4197	3845	25·0	21·48
Drugs	615	390	3·6	2·17
Wines, Spirits, and Beer	1615	2220	9·7	12·36
Bread and Flour	1471	1326	8·7	7·40
Water	1240	1604	7·5	9·04
Sundries	629	391	3·7	2·18
	16,772	17,919	100·0	100·00

The adulterated samples, 3132 in number, are divided in the following proportions, the results for the year 1879 being appended, as before, for comparison. The percentages are calculated on the total number of samples found to be adulterated in each year.

SAMPLES FOUND ADULTERATED, OR IN THE CASE OF WATERS, UNFIT TO DRINK, 1879 AND 1880.

	Numbers. 1879.	1880.		Percentage. 1879.	1880.
Milk	1332	1595	..	44·72	50·98
Butter	135	179	..	4·53	5·73
Groceries	492	402	..	16·52	12·90
Drugs	164	79	..	5·52	2·52
Wines, Spirits, and Beer	457	480	..	15·36	15·18
Bread and Flour	68	84	..	2·28	2·68
Waters	266	287	..	8·93	9·18
Sundries	64	26	..	2·14	·83
	2978	3132		100·00	100·00

It is important to observe how the percentages of adulteration stand as compared with previous years when each percentage is calculated on its own class of samples and not on the general total of samples analysed.

PERCENTAGES OF ADULTERATION FOUND FROM 1877 TO 1880, CALCULATED ON THE NUMBER OF SAMPLES OF EACH CLASS ANALYSED.

	1877.	1878.	1879.	1880.
Milk	26·07	18·38	22·06	22·00
Butter	12·48	13·23	13·93	20·08
Groceries	13·00	12·89	11·73	10·43
Drugs	23·82	35·77	26·66	20·26
Wine, Spirits and Beer	47·00	29·31	28·30	21·31
Bread and Flour	6·84	2·97	4·62	6·33
Water	21·63	14·98	21·45	17·73
Sundries			10·17	6·66

Taking the samples examined in 22 of the Metropolitan Districts by themselves, we find that the total number purchased was 2672, of which 406 or 15·19 per cent. were adulterated. The samples are divided thus :—

METROPOLITAN DISTRICTS—PERCENTAGE OF ADULTERATION, 1880.

	Examined.	Adulterated.	Percentage.
Milk	1043	276	26·46
Butter	196	40	20·41
Groceries	743	63	8·48
Drugs	116	11	9·40
Wines, Spirits and Beer	164	10	6·09
Bread and Flour	235	6	2·55
Waters	42	0	—
Sundries	114	0	—
	2653	406	Avge. 15·19

Again, taking the returns from 150 of the towns of the Kingdom, we find that 7149 samples have been examined, of which 1279 or 17·87 per cent. were adulterated. These are divided as follows :—

TOWNS IN THE UNITED KINGDOM—PERCENTAGE OF ADULTERATION, 1880.

	Examined.	Adulterated.	Percentage.
Milk	3743	816	21·80
Butter..	288	75	26·13
Groceries	1105	75	6·78
Drugs	23	5	21·74
Wines, Spirits, and Beer	459	110	23·97
Bread and Flour	560	38	6·79
Waters	829	128	16·30
Sundries	142	10	6·04
	7149	1279	Avge. 17·87

Again, taking the 65 returns from the counties and divisions of counties we have a t of 8117 samples examined and 1447 adulterated, the total being divided as follows :—

Counties in the United Kingdom—Percentage of Adulteration, 1880.

	Examined.	Adulterated.	Percentage.
Milk	2465	503	20·40
Butter..	408	64	15·69
Groceries	2044	252	13·15
Drugs	215	83	38·07
Wines, Spirits, and Beer	1597	341	22·10
Bread and Flour	531	40	7·55
Waters	722	148	20·50
Sundries	135	16	11·85
	8117	1447	Avge. 17·84

In order to enable a ready comparison to be made, I will now place side by side percentages of adulteration as shown to exist in London, the larger towns and the coun respectively, simply premising that 14·9 per cent. of the total samples were purchase London, 39·9 per cent. in the towns, and 45·3 per cent. in the counties.

Metropolis, Towns, and Counties—Percentage of Adulteration, 1880.

	London.	Large Towns.	Counties.	Whole Country
Milk	26·46	21·80	20·40	22·00
Butter	20·41	26·13	15·69	20·08
Groceries	8·48	6·78	13·15	10·43
Drugs	9·40	21·74	33·07	20·26
Wines, Spirits, and Beer	6·09	23·97	22·10	21·31
Bread and Flour	2·55	6·79	7·55	6·33
Waters	—	16·30	20·50	17·73
Sundries	—	6·04	11.85	6·66
Average	15·30	17·87	17·84	17·47

It will only be possible to glance comparatively briefly at the indications of th various statistics. Referring first, then, to the general summary of adulteration in whole country we find that Milk adulteration remains almost stationary, the difference f last year being only ·06 per cent. The adulteration of butter has increased very serio from 13·93 to 20·08 per cent. It is clear that this very serious increase points to a n systematic substitution of Butterine for Butter in retail sales. This fraudulent substitu is greatly to be regretted, not only because it is an offence, but because it is standing in way of a fair and proper trial of Butterine under its own name for purposes for which suited.

Groceries show 1·30 per cent. less adulteration than in 1879. The adulteration of dr appears to have decreased in three years from 35·77 per cent. to 26·66 per cent., an now 20·26 per cent.

There is a diminution of nearly 7 per cent. shown in the adulteration of wines spirits.

The adulteration of bread and flour shows a most serious increase, the results of last three years having been 2·97, 4·62 and 6·33 per cent. respectively. The percen of adulteration as shown has more than doubled in two years.

The serious increase in the adulteration both of bread and flour and of butter, hardly be due, as was surmised last year, to the improvements in the methods of anal *for no* noteworthy step in advance in reference to either of these classes of samples has b

rought into use during the year. It seems rather to point to the necessity for the urchase of a larger number of samples by the Inspectors.

The new feature which we have introduced into the summary this year by the separation of the London Districts, the large towns and the counties, is deserving of some few words of special notice. London appears still to be the worst part of the Kingdom for ilk adulteration; the percentage, which over the entire country was 22·00, rising in the etropolis itself to 26·46. Even, however, in the counties, where one would suppose tering milk would be less prevalent, the percentage of adulterated samples is 20·40.

Butter does not appear to follow exactly on the same lines as milk, for whereas in ondon 20·41 per cent. of the samples were found adulterated, the towns show more than 26 per cent., and the counties less than 16 per cent.

In groceries the counties are markedly the worst, the percentage of adulteration ching 13 per cent. as against 8·48 per cent. in London.

In drugs, again, the county districts appear to suffer greatly. The percentage in ndon, however, viz., 9·40, appears large, considering the care which is supposed to be en in the Metropolis in procuring supplies of pure drugs.

When the totals of each class of sample are put together and averaged, we find that ere is little to choose between Metropolitan, urban and rural districts, and even in ondon the average of the whole of the samples purchased shows 15·3 per cent. adulterated.

Of the counties there are 8, where only a very small and insufficient number of samples have been analysed, viz., Denbigh, Montgomery, Shropshire, Waterford, N.R. Yorkshire, Cambridge, Carmarthen, and Northumberland, but in this respect the returns appear to show a slight improvement over last year.

There are 41 towns, viz., Barnsley, Chesterfield, Andover, Beverley, Louth, Glossop, Wenlock, Lancaster, Dumbarton, Richmond (Yorkshire), Ripon, Wakefield, Deal, Dover, Sandwich, Derby, Warwick, Hereford, Lichfield, Blandford, Stirling, Androssan, Stewarton, Arundel, Chichester, Newington, Tenterden, Bury, Southwold, Devonport, Penryn, Durham, Maidenhead, Godalming, Reigate, Bewdley, New Radnor, Droitwich, Birkenhead, and Rutherglen, and two counties, viz., Suffolk and Sutherland, where no work appears to have been done last year under the Act. In 1879 there were 44 towns in the same condition, and 19 of the towns appear in the list for both years, as do also the 2 counties of Suffolk and Sutherland.

It is to be hoped that in every one of these cases the Public Analysts have strictly complied with the Act, and made quarterly reports to the appointing authorities in order that these reports may have been duly forwarded to the Local Government Board, whose attention will thus have been called to such an anomalous state of things. It might also be desirable to draw their attention to this yearly return.

At the Meeting of the Society, on the 11th inst., I hope to be able to remark on some further details in connection with these returns, in order that some points which need consideration may be fully discussed.

LABELS.—We have received specimens of the labels for reagents issued by Messrs. Woolley, Sons & Co., for the series required for the examination of the Science and Art Department. The novel feature is that the two series are printed in two different colours, one for general and one for personal use. Under certain circumstances the advantage of this system in preventing admixture of series of bottles is obvious. The labels are clearly printed.

CORRESPONDENCE.

[The Editors are not responsible for the opinions of their Correspondents.]

THE WATER SUPPLY OF PHILADELPHIA, U.S.A.

To the Editor of "The Analyst."

Dear Sir,—I send herewith the report of the analysis of a sample of water taken from laboratory hydrant on March 31st, 1881.

SCHUYLKILL WATER.

Appearance in 2ft. tube ..	Very slightly yellow.
Smell at 100°F. ..	Very feebly musty.
Chlorine ..	0·27
Phosphoric Acid ..	None.
Nitrogen as Nitrates and Nitrites	0·500
Oxygen absorbed in two minutes	None.
" " " four hours	0·560
Hardness before boiling	4·5
" after "	4·5
Free Ammonia ..	·0056
Albuminoid Ammonia ..	·0112
Total Solids ..	7·03
Sediment ..	Vegetable debris and siliceous fragments.

The dry residue turns only brown, not black, on heating to redness. The water does not become perceptibly turbid except upon long boiling (4 or 5 hours) when minute mica-like scales are formed. The nitrates were determined by aluminium and caustic soda. The colour and smell are very faint and doubtful.

HENRY LEFFMAN, M.D.

920, *Walnut Street, Philadelphia, April 4th*, 1881.

ANALYST'S REPORT.

At the Somerset Quarter Sessions, held in the Town Hall, Wells, the report of Dr. Alford, of Taunton, the County Analyst, was presented. He said that during the last quarter he had submitted to him altogether 160 samples of food and drugs. There were 23 of butter, 23 of tea, 9 of mustard, 11 of arrowroot, 4 of pepper, 2 of sugar, 1 of coffee, 2 of jam, 1 of confectionery, 2 of ginger, and 2 of liquorice. Of these the coffee was adulterated with 35 per cent. of chicory, and one of the samples of mustard with 20 per cent. of wheaten flour. Many of the butters were of a very inferior quality, especially the salt butter, and many were rancid. The Chairman (Mr. R. H. Paget, M.P.) said he wished to call the attention of the Court to the large importation of spurious butters which were sold. These, they had every reason to believe, were very extensively imported from America, and found their way to England from that country. They had a name, but they were never openly sold in any market as butterine and oleomargarine, and without any process of conversion they found their way into the English market as butter. If the analysis made showed that these compounds were not what they were represented to be, an offence would be committed under the Adulteration of Food Act by anyone exposing them for sale, and he suggested to the Court that they should call the attention of the chief constable, who was the chief inspector under the Act in that county, to this point, and also call the attention of the County Analyst to it, that they might do their best to protect the consumers from eating these spurious and fictitious compounds. Would the chief constable be good enough to call the attention of the police to the matter? Captain Goold (chief constable) said he would not lose sight of the matter. He then made a communication to the Chairman, which was inaudible to the other occupants of the Court. The Chairman said the Court would be glad to hear that there were only four cases of adulterated goods proved in the course of the quarter, and prosecutions had taken place in those cases, and fines to the extent of £4 7s. 6d. imposed. The subject then dropped.

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; Journal of Applied Science; The Boston Journal of Chemistry; The Provisioner; The Practitioner; New Remedies; Proceedings of the American Chemical Society; Le Practicien; The Inventors' Record; New York Public Health; The Scientific American; Society of Arts Journal; Sanitary Engineer of New York; The Cowkeeper and Dairyman's Journal; The Chemists' Journal; Oil and Drug News; The Textile Record of America; Sugar Cane; Country Brewers' Gazette.

THE ANALYSES OF THE PUBLIC WATER SUPPLIES OF ENGLAND.

Our readers will observe two slight changes in the headings of the water returns for this month. The chlorine and phosphoric acid returns are now tabulated as "chlorine as chlorides" and "phosphoric acid as phosphates." These changes are made in anticipation of the enlarged instructions for water analysis, the issue of which will commence in the next number of this journal. It is intended that in future the tables should give the analyses of samples drawn at any date between the 15th of one month and the 14th of the next inclusive. Thus the tables published in June will include the analyses of waters supplied between April 15th and May 14th. The dates on which the samples were drawn will also be added to the tables.

ANALYTICAL WORK AT SOMERSET HOUSE.

The Twenty-Third Report of the Inland Revenue Commissioners has recently been issued, and we take the following extracts from the Report of the Principal of the Laboratory :—

The number of samples examined during the year ended the 31st March, 1880, was 15,113, which is 208 in excess of the previous year.

In addition to the ordinary work of the department we have continued our investigation into the chemical composition of various articles of food, and we hope shortly to publish the results in a form in which they will prove useful to analysts and others. A series of food analyses accurately performed, and of recent date, is an important desideratum, and the want is one which we are endeavouring to supply.

Under the provisions of the Sale of Food and Drugs Act the magistrates have referred 26 samples to us for analysis. These comprised milk, butter, flour, oatmeal, coffee, whisky, and mercurial ointment, and in fifteen of the cases our certificate differed from that of the public analyst. Three of these cases consisted of coffee said to contain an admixture of chicory, and the difference in the nature of the certificates did not depend, as in some cases, upon the results of a chemical analysis, for not only were these results in favour of the genuineness of the samples, but by the microscope alone the absence of chicory could be conclusively shown. Three samples of flour alleged to be adulterated with alum were found to contain a slight excess of alumina probably derived from an earthy impurity, but the results of the analysis showed that the flour in each case was entirely free from alum. A sample of mercurial ointment, which was below the standard of the British Pharmacopœia, was found to agree with what is known in the trade as "mild mercurial ointment," and for the preparation of which a formula was given in the London Pharmacopœia of 1836. Finding this to be the case we reported accordingly, and it afterwards appeared that the article was labelled and sold under its proper designation as "mild mercurial ointment." The sample of whisky was said to consist of ordinary alcohol flavoured, but we found it to be composed of a blend of two kinds of spirits commonly known as "patent" and "pot still" whisky. A notable case of alleged abstraction of cream formed one of the samples of milk recently referred to us. The results of our analysis of the sample were as follows :—

Solids not fat	8·54 per cent.
Fat	2·33 ,,
Ash	·71 ,,

On these results we reported that we were unable to affirm that cream had been abstracted.

It appears that the magistrates came to the conclusion that it would be better to get

Analyses of English Public Water Supplies in April, 1881. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine as Chlorides.	Phosphoric Acid as Phosphates.	Nitrogen as Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in		Hardness, Clark's Scale, in degrees.		Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
								2 mins. at 80° Fahr.	4 hours at 80° Fahr.	Before Boiling.	After Boiling.			
Kent Co.	c. blue green	none	2·13	trace	·440	none	0033	none	·0098	21·6°	8·5°	33·00	satisfactory	Wigner & Harland.
New River	clear v. f. yellow	none	1·12	traces	·200	·0014	·0021	·0070	·0397	13·4°	2·8°	18·76	satisfactory	B. Dyer.
East London ..	greenish	none	1·26	trace	·250	·0030	·0015	none	·0194	17·6°	4·7°	22·80	veg. debris and fibres	Wigner & Harland.
Southwark & Vauxhall ..	v. slight yellow	none	·96	trace	·140	·0007	·0049	·(045	·0537	14·5°	3·5°	19·60	traces mnl. mtr. & diams.	J. Muter.
West Middlesex	faint yellow	none	1·05	trace	·150	·0012	·0048	none	·0450	14·5°	4·6°	19·60	none	O. Hehner.
Grand Junction	v. p. yellow	none	·96	trace	·110	·0025	·0042	·0052	·0652	13·0°	3·9°	19·98	none	A. Wynter-Blyth.
Lambeth	v. s. yellow	none	1·24	trace	·120	·0007	·0025	none	·0537	15·0°	4·0°	20 50	traces minl. and diatoms	J. Muter.
Chelsea	c. p. green. yelw.	none	1·01	trace	·170	·0014	·0049	·0056	·0672	16·0°	4·0°	19·88	animalculæ and diatoms	A. Dupré.
Bath	c. pale blue	none	·90	none	·150	none	·0001	·0019	·0030	17·0°	5·0°	23·85	none	J. W. Gatehouse.
Birmingham ..	greenish yellow	none	·98	traces	·130	·0020		·0110	·3050	10·3°	4·7°	17·74	vegetable matter	A. Hill.
Bradford	s. peaty yellow	none	·70	none	none	none	·0021	·0300	·1400	3·9°	3·7°	7·80	none	F. M. Rimmington.
Brighton......	c. p. green blue	none	2·13	none	·430	·0025	·0025	none	none	12·3°	4·6°	25·20	trs. veg. deb. & animalculæ	Wigner & Harland.
Bristol........	f. bwn. grn. cldy.	none	·68	v. s. trace	·060	none	·0058	·0021	·0130	14·8°	1·2°	20·40	sand diatoms	F. W. Stoddart.
Cambridge	c. pale blue	none	1·47	traces	·510	·0014	·0010	none	·0154	·2°	4·5°	25·20	satisfactory	J. West-Knights.
Canterbury	pale blue	none	1·47	none	·340	·0005	·0007	·0050	·0110	5·0°	4·5°	10·36	traces, mineral	S. Harvey.
Croydon	f. bluish green	none	1·05	trace	·330	·0010	·0012	none	·0140	15·5°	5·0°	24·80	no sediment	C. Heisch.
*Croydon	f. bluish green	none	1·19	trace	·360	·0005	·0020	none	·3120	16·0°	6·0°	23·20	no sediment	C. Heisch.
Derby	v. good	none	·90	traces	·110	none	none	none	·0130	10·9°	5·0°	17·29	satisfactory	L. Archbutt.
Dublin	s. yellow	none	.98	trace	traces	·0020	·0080	none	·0450	1·4°	1·0°	4.50	satisfactory	C. A. Cameron.
Edinburgh	slightly brown	none	·72	none	v.s trc.	·0016	·0080	·0128	·1504	4·4°	3·45°	5·04	none	J. Falconer King.
Exeter	f. grnsh. yellow	none	·84	v. s. trace	·180	·0023	·0039		·0546	2·9°	2·9°	7·00		F. P. Perkins.
Grantham	pale blue	none	·91	f. traces	·500	·0022	·0027	none	·0125	15·7°	5·9°	22 37	few diatoms	A. Ashby.
Huddersfield ..	yellow brown	slight	·50	none	·010	·0042	·0056	·0030	·0040	2·0°	2·0°	5·00	peaty mttr. movg. orgsm	G. Jarmain.
Hull	good	none	1·40	mere traces	·310	·0030	·0043	·0017	·0190	17·2°	4·0°	29·00	satisfactory	J. Baynes, Jun.
Ipswich	c. colourless	none	2·45	trace	·620	·0028	·0040	none	·0098	23·5°	4·2°	33 75	satisfactory	J. Napier.
King's Lynn ..	dirty milky ylw.	vegetable matter	1·59	h. trace	·430	·0056	·0098	·0437	·1802	14 7°	4·8°	21·14	vegetable debris	W. Johnstone.
Leeds	light brown	none	·62	traces	none	none	·0039	·0110	·0950	3·6°	2·8°	4·76	animalculæ diatoms sand	T. Fairley.
Leicester	v. s. yellow	none	1·33	trace	·130	·0020	·0030	·0035	·0780	7·8°	4·0°	14·80	satisfactory	W. L. Emmerson.
Liverpool	yellowish	peaty	1·02	traces	·070	·0014	·0017	·0084	·1260	4·9°	4·3°	8·96	satisfactory	A. Smetham.

* One sample is from the Upper and one from the Lower part of the town.

Analyses of English Public Water Supplies in April, 1881. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine as Chlorides.	Phosphoric Acid as Phosphates.	Nitrogen as Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in 2 mins. at 80° Fahr.	Oxygen, Absorbed in 4 hours at 80° Fahr.	Hardness, Clark's Scale, in degrees. Before Boiling.	Hardness, Clark's Scale, in degrees. After Boiling.	Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
Maidstone—														
Wtr. Company	clear	none	2·70	traces	·820	none	·0014	·0056	·0171	19·0°	6·8°	34·16	satisfactory	M. A. Adams.
Public Conduit	clear	none	2·30	s. trace	·920	none	·0010	·0028	·0123	20·0°	8·5°	35·80	satisfactory	M. A. Adams.
Manchester....	c. f. yellowish	none	·73	none	none	·0026	·0039	·0107	·0730	1·1°	1·1°	5·10	s. mineral	W. Thomson.
Newark	pale blue	none	1·12	v. f. trace	·020	·0011	·0039	none	·0347	16·5°	10·9°	30·80	moving organisms	A. Ashby.
Newcastle-on-Tyne......	faint yellow	none	·94	s. trace	·050	·0010	·0080	·0060	·0800	16·2°	4·7°	20·70	satisfactory	J. Pattinson.
Norwich	s. green yellow	none	1·70	s. trace	·070	traces	traces	·0018	·0740	13·2°	3·8°	17·60		W. G. Crook.
Nottingham ..	greenish blue	none	2·13	traces	1·590	·0014	·0019	none	none	20·4°	12·5°	28·80	vegetable deb. mycelium	Wigner & Harland.
Oldham	s. turbid yellow	none	·85	h. traces	·030	·0151	·0033	·0008	none	4·2°	3·8°	5·68		C. Estcourt.
Plymouth	colourless	none	·85	none	·400	·0010	·0046	none	·0360	2·8°	2·6°	4·30	none	R. Oxland.
Portsmouth ..	clear	none	1·19	trace	·290	trace	·0031	none	·0518	15·1°	6.0°	17·50		W. J. Sykes.
Reading	f. green yellow	none	·95	s. trace	·120	·0005	·0042	·0060	·0490	14·2°	4·1°	18·00	satisfactory	J. Shea.
Rochdale	pale blue	none	·60	none	·010	·0014	·0021	·0014	·0280	3·5°	1·5°	4·60	satisfactory	T. A. Collinge.
Rotherham....	yellowish	none	1·60	trace	none	·0056	·0014		·0105	13·9°		20·65	satisfactory	A. H. Allen.
Rugby	v. f. turbid no colour	none	1·69	h. traces	·310	·0028	·0042	·0112	·0210	8·5°	7·8°	14·00	vegetable deb. bacteria	A. P. Smith.
Salford	opaque yellow	none	·70	none	none	·0014	·0056	·0140	·1148	3·0°	2·5°	5·50	oxide of iron	J. Carter Bell.
Sheffield	brownish s. turbid	none	·50	none	none	·0014	·0049	none	·0660	4·8°	4·5°	5·31	satisfactory	A. H. Allen.
Shrewsbury ..	c. colourless	none	1·35	traces	·350	·0005	·0015	none	none	22·1°	4·5°	25·40	none	T. P. Blunt.
Southampton..	green yellow s. turbid	none	.98	trace	·160	·0010	·0070	·0080	·064	15·2°	4·7°	19·80	vegetable debris	A. Angell.
Stockport	v. s. turbid yellowish	none	·88	h. traces	·020	·0016	·0042	·0018	·0122	4·5°	3·8°	4·44	peaty matter	C. Estcourt.
Sunderland....	c. colourless	none	2·00	trace	·250	·0021	·0030	·0020	none	9·6°	3·7°	25·00	vegetable debris	H. J. Yeld.
Swansea	s. turbid	none	·90	trace	none	·0007	·0042	·0020	·0035	2·5°	2·0°	3·67	earthy matter	W. Morgan.
Whitehaven ..	clear faint green	none	·38	none	·010	none	·0009	none	·0090	·4°	·4°	1·82	satisfactory	A. Kitchin.
Wolverhampton	pale yellow	none	1·33	h. traces	·140	none	·0070	·0013	·0688	12·6°	6·7°	21·56	desmids and diatoms	E. W. T. Jones.
Worcester	pale yellow s. turbid	none	3·70	trace	·260	none	·0070	·0084	·0910	17·0°	6 9°	24·08	sand and clay	H. Swete.

Abbreviations:—c., clear; f., faint; h., heavy; p., pale; v. h., very heavy; v. s., very slight.

ERRATA.—In the March Table, the Oxygen of the RUGBY water absorbed in 2 mins. should have been ·0140, in 4 hours ·0704; and the Oxygen of the STOCKPORT water absorbed in 2 mins. should have been ·0028, in 4 hours ·0092.

another sample of milk from the farm, from the same cow from which the previous sample was supposed to have been taken. A second sample was accordingly obtained by arrangement and analysed by the public analyst who reported that the milk was probably "fore milk," and had been deprived of at least twenty per cent. of its cream. On receipt of this certificate the magistrates thought that some tampering with the cow had taken place, and with the view of removing all possible doubt as to the genuineness of the milk, instructed their Inspector to revisit the farm, without giving the farmer notice of his intended visit, and to procure a sample from the same cow. The Inspector accordingly revisited the farm and obtained another sample of the milk as directed. On this sample being analysed in this department, the amount of fat was found even less than before, while the "solids not fat" and the ash were practically the same. It was, therefore evident that the cow yielded milk of a low quality, and the case is quoted as showing the care which is necessary in reporting upon the analysis of a natural product like milk, the composition of which varies so much.

Complaints having been made as to the quality of the ink supplied for use by the Stationery Office, the subject was referred to us by that department for investigation and report. We found that the ink in use was not a pure nutgall ink, and that it soon became thick and clogged the pen. After numerous experiments we recommended the adoption of an ink made entirely from nutgalls, iron, and gum. Such an ink runs freely from the pen, and although pale when first used it soon deepens on exposure to an intense and permanent black.

The examination of postage and other stamps with reference to the adoption of colouring matters which cannot be tampered with without detection has formed a part of our work during the year. It is well known that the pigment of the old penny postage stamps became hard by age, and that by certain solvents it was possible to remove the obliterating marks and thus render the stamps available for use a second time. In a new contract which was about to be entered into for such stamps it was made essential that they should be surface printed, and that the colouring matter should be what is known as "doubly fugitive." The adoption of the cheaper process of surface printing rendered practicable the use of colouring matters much more fugitive than hitherto. After careful investigation the stamps now in use were adopted, not only for their superiority in fugitiveness of colour, but also in quality of gum and excellence of workmanship.

Forty-seven cases have been attended by the analysts from this department, and penalties amounting in the aggregate to £1,288 10s. have been awarded. A conviction ensued in every case, except one, and in this case the chemical witness was not examined. Two of the cases were heard under the Summary Jurisdiction Act, which came into operation on the 1st of January last, and are interesting as showing penalties of £200 and £2 10s. respectively for practically similar offences. Our experience has, however, as yet been too limited for any general conclusion to be drawn as to the effect which this Act is likely to have upon the security of the revenue.

Twenty-nine examiners have received the usual course of instruction.

Six students completed their course of instruction during the year, and at the final examination by Dr. Frankland four received first class certificates and two second-class certificates, but it is only just to one of the latter to say that his course of study was *materially interfered with* by serious personal illness.

COFFEE AND CHICORY.

Six samples have been examined, all of which were legally genuine, with the exception of one which contained ground date stones.

BEER.

Under this head, which includes beer and materials used for its adulteration, a very large number of samples have been examined during the year. Several officers, acting frequently upon private information, have visited a large number of publicans in London, and wherever they suspected the existence of fraudulent practices, they took samples for analysis, and it is but just to these officers to say, that, as a rule, the samples were taken with great judgment, and that the analysis in a very large majority of the cases confirmed their suspicions. It is quite evident from the admissions made by the publicans to these officers, and from the results of the examination of these samples, that the addition of sugar to beer prevails very extensively, if not universally, among the publicans in the metropolis. Several publicans were detected twice within the course of a few weeks, while others candidly admitted that it was their usual practice to add a saccharine solution to their beer, and especially to their porter.

Out of a total of 673 samples examined, there were 526 to which sugar had been illegally added, or which consisted of materials intended to be used for the adulteration of beer.

BAKING POWDERS IN THE UNITED STATES.

From the New York Tribune.

ALUM BAKING POWDERS IN COURT. INTERESTING TESTIMONY OF SCIENTIFIC MEN.

Within the past two years a bitter controversy has been waged between manufacturers, on account of the use of alum as a cheap substitute for cream of tartar by many manufacturers of baking powders. The handsome profits yielded by using the substitute have induced dealers as well as manufacturers to push them into the hands of consumers, sometimes under definite brands, frequently by weighing out in bulk without any distinguishing name.

Are such powders wholesome? The Royal Baking Powder Co., who make a cream of tartar baking powder, declared that they are injurious to the public health, while others who make alum powders claim that they are not. The whole matter as to the effects of these alum powders has finally been brought into the courts, and the case was tried in the Superior Court of New York city before Chief Justice Sedgwick, reported substantially as follows in the New York *Sun.*

The suit of Dr. Henry A. Mott against Jabez Burns, has brought to light the fact that this country produces at least forty-two different kinds of baking powders. Neither Burns nor Mott has been found guilty of making the baking powders, but Burns, who is the editor of a periodical called the *Spice Mill*, has been severely mulcted for libel in his efforts to make his paper spicy. Dr. Mott, it appears, is a chemist, and was at one time employed by the United States Government to analyse different specimens of baking powder which had been recommended for adoption to the Indian Bureau. Dr. Mott reported in favour of the cream of tartar baking powders for the Indians, and against the alum baking powders. The chemist analysed forty-two kinds of baking powders.

The jury were out about half-an-hour. They came in with a verdict awarding Dr. Mott 8,000 dols., to which the Court made an additional allowance of 150 dols.

As the public have a large interest in the wholesomeness of whatever it is called upon to use as food, the following extracts are introduced from the testimony of some of the prominent men as to the injurious effects of alum powders:—

Dr. Mott: I was employed as chemist by the United States Government to analyse all the articles of food; to express an opinion as to the analysis of their healthfulness and purity. I examined baking powders. It would be difficult to remember them all; I could refer to my books; I examined twenty-eight powders; was given sixteen at first. And among the powders included was "Dooley's Baking Powder," the "Charm," and "Patapsco." I found alum in Dooley's, "Patapsco," "Charm," "Queen," "Vienna,"

"Orient," "Amazon," "Lake Side," "Twin Sisters," "Superlative," "King," "White Lily," "Monarch," "One Spoon," "Regal," "Imperial," "Honest," "Economical," "Excelsior," "Chartres," "Grant's," "Giant." It is my opinion, based upon actual experiments on living animals, that alum in these various compounds, in baking powders such as I have examined, is injurious.

Dr. Charles F. Chandler, called on behalf of the plaintiff, testified as follows:—I reside in the City of New York. My business is that of a chemist. I am, and have been Professor of Chemistry in several colleges. I am at present Professor of Chemistry in the Academic Department of Columbia College; the School of Mines, Columbia College; the New York College of Physicians and Surgeons, and the New York College of Pharmacy. I am President, also, of the Board of Health. I have had frequent occasion to examine the question of wholesomeness of food, and the beneficial or injurious effects of its ingredients. There is an injurious constituent left after the mixture of alum and bicarbonate of soda in a baking powder. I think it is dangerous to the digestive organs, and liable to produce serious disturbance of the liver of the individual making use of such powders.

Henry Morton, President of Stevens Institute, testified as follows:—I am President of Stevens' Institute. I have for many years been a chemist. I have had occasion to examine the substances which are used in the composition of baking powders. Some time ago I examined a sample of Dooley's Baking Powder. It contained potash alum. I did make an extract of that alum, to show the kind. I extracted a large quantity of it as potash alum, and it is in that bottle which I have now here [showing bottle]; that is potash alum which came out of the alum baking powder that was in that can. I took a portion of this powder and mixed it with flour in the directed proportions, and baked a small loaf with it; then I soaked this loaf—the interior part of it—in cold water, and made an extract, in which I readily detected, by the usual tests, alum—that is, alumina in a soluble condition.

Q. Does any baking powder in which any alumina salts enter, contain alumina, in your opinion, which can be absorbed in the process of digestion—are not such objectionable?

A. Very decidedly objectionable, in my opinion.

Q Why do you say—from what system of reasoning do you make it out—that because alum is injurious, alumina is injurious?

A. Because the injurious effects of alumina, when it gets into the stomach and reacts on the organs, are the same; this hydrate of alumina meets in the stomach the gastric juices, and reacts with them the same as alum would; it forms, in fact, a kind of alum in the stomach with those acids, and whatever alum would do, it would do.

Dr. Samuel W. Johnson, Professor of Chemistry in the Scientific School, Yale College, testified as follows:—I have had much to do in the examination of substances that enter into food, and the adulteration of food?

Q. After the use of alum with soda, in a baking powder, in your opinion, is there any injurious substance left?

A. In my opinion, there is an injurious substance left.

Q. What, sir, two years ago, was the prevailing opinion among scientific men, as to the effect of the use of alum in baking powders?

A. As far as my acquaintance with scientific men is concerned, my personal opinion is derived from my investigation and from reading; I should think the opinion was that alum, or any compound of alumina, would be decidedly injurious.

Q. Do I understand you to say that any baking powder in which there are aluminous salts, or any resultant from alum which could be absorbed in digestion, is objectionable and injurious?

A. Extremely so.

Prof. Joseph H. Raymond testified as follows: I am a physician and professor of physiology. I have been for some time Sanitary Superintendent in Brooklyn.

Q. Now, sir, I will ask you your opinion, from this experience, whether the use of alum with soda, in a baking powder, is injurious or not, in its physiological effects?

A. I consider it to be dangerous.

Q. You examined this question for the Board of Health in Brooklyn, some years ago. What was the result of your investigation as to the use of alum in baking powder?

A. The result of my investigation at the time was this: that the changes which took place between the time that alum baking powder was put in the bread, and the time the bread was eaten, the chemical changes were so little understood by chemists, that as a physician and physiologist, I considered it a dangerous experiment.

Dr. Mott, the Government chemist, in his review on the subject in the *Scientific American*, makes

special mention of having analysed the Royal Baking Powder, and found it composed of pure and wholesome materials. He also advises the public to avoid purchasing baking powders as sold loose or in bulk, as he found by analyses of many samples that the worst adulterations are practiced in this form. The label and trade mark of a well-known and responsible manufacturer, he adds, is the best protection the public can have.

LAW REPORT.

Recently Mr. Bruce, the stipendiary magistrate at Leeds, gave his decision in a case heard before him in which Superintendent Newhouse summoned Messrs. Wilcock & Son, provision dealers, Kirkgate for selling butterine instead of butter, as asked for by the purchaser. Mr. Bruce said this was an information under the Food and Drugs Act, 1875, charging the defendants, Wilcock & Son, with selling to the prejudice of the purchaser, John Newhouse, an article of food, butterine, which was not of the nature, substance, and quality of the article, butter, demanded by the purchaser. At the close of the complainant's case, Mr. Warren, for the defendants, submitted that certain conditions precedent to a prosecution under the Act had not been complied with, those conditions being contained in Sections 14 and 15 of the Act, which provide that the purchaser shall, after the purchase shall have been completed offer to divide the article into three parts, to be then and there separated, and each part to be marked and sealed, or fastened up in such manner as its nature will permit, and shall, if required to do so, proceed accordingly, and shall deliver one of the parts to the seller or his agent. He shall afterwards retain one of the said parts for future comparison, and submit the third part, if he deems it right to have the article analysed, to the analyst (Section 14). But if the seller or his agent do not accept the offer of the purchaser to divide the article purchased in his presence, the analyst receiving the article for analysis shall divide the same into two parts, and shall seal and fasten up one of those parts, and shall cause it to be delivered either upon the receipt of the sample or when he supplies his certificate to the purchaser, who shall retain the same for production in case proceedings shall afterwards be taken in the matter (Section 15). At the hearing of the information in such proceedings, the articles retained by the person who purchased the article shall be produced (Section 31.) The evidence of Newhouse, the purchaser-in-chief, was, "I said [to the seller], 'I will divide the butter if you wish, and leave a portion with you.' He said, 'Oh, no; it does not matter.'" On cross-examination, he gave this account of the matter:—"I said I would divide it into three portions. I am not sure whether I mentioned three parts. I believe the words I used were, 'I will divide the butter, and leave a portion with you.' I did not say I would mark it or seal it. I did not fasten it up." There was no evidence that Section 15 had been complied with, nor was there any production of articles under Section 21. Upon the statute and the facts Mr. Warren contended—(1) that no offer had been made to the seller by the purchaser in the terms of Section 14; (2) that if such offer had been made, then there was no proof of compliance with the terms of Sections 15 and 3; and (3) that these were conditions precedent to the prosecution, citing Barnes *v.* Chipp, L. R. 3, Ex. D. 176. On the part of the prosecution, it was urged by the Town Clerk—(1) that the evidence showed that the purchaser had offered to divide the butter and leave a portion with the seller, and that this offer having been refused, it was not necessary for him to offer to divide the article into three parts, each part to be marked and sealed or fastened up; (2) that if a sufficient offer had been made under Section 14, it was not necessary to prove compliance with Section 15, or to produce the article under Section 21; (3) that the procedure under Sections 14 and 15 was only a mode of ascertaining the genuineness of the article, and did not form part of the substance of the offence, citing certain expressions used by Mr. Justice Lush in Horder *v.* Scott, L. R. 5, Q. B. D. 555, and therefore as the Town Clerk argued, did not require proof. I should have thought, if there had been no authority on the subject, that at the most the objections taken by Mr. Warren were mere objections to receiving the analyst's certificate in evidence, and that that having been put in, I said it was too late to take objections founded on Sections 14 and 15, but in Barnes *v.* Chipp it was decided that it was a condition precedent to a prosecution under the act that the purchaser should notify to the seller his intention to have the article, not merely analysed, but analysed by the Public Analyst. This requirement as to the notification of intention to have the article analysed by the Public Analyst occurs in the same sentence, and, as it were, in the same breath, with the requirement of the offer to divide into three parts sealed or fastened up. If the one is a condition precedent to the prosecution, it is difficult to imagine any ground on which the other case should be held not to be so. If, then, the offer to divide the article into three parts, to be then and there separated, and each part to be marked and sealed or fastened up in such a manner as its nature will permit, is a condition precedent to the prosecution, was such an offer made in this case? Newhouse, the purchaser, said, "I will divide the butter, and leave a

portion with you"; and to this the seller said, "It's no matter; I have plenty here." This offer was certainly not made in the terms of the statute, and I am of opinion that it ought to have been so made. I do not say that every word used in the statue should have been used by the purchaser but there ought to have been an offer by him then and there to separate the article into three portions, and to mark and seal or fasten them up. The words of the statute are plain and simple, and it is the offer prescribed by them which is to be made, and not some other. But supposing the offer made and the refusal of it were sufficient under Section 14, I am of opinion that the provisions of Sections 15 and 16 not having been complied with, no conviction could take place in this case, for a compliance with Section 15 appears to me to be just as much a condition precedent to the prosecution as a compliance with Section 14; and although a compliance with that part of Section 21 which requires that at the hearing of the information the parts of the article retailed by the person who purchased the article shall be produced is not a condition precedent by the prosecution, yet where their non-production is challenged by the defendant, as in this case, it must be a condition precedent to a conviction, otherwise the requirement of their production by the statute would be nugatory. It is quite true, as said by Mr. Justice Lush in Horder *v.* Scott, that the procedure under Sections 14 and 15 do not form part of the substance of the offence; but, in the words of Chief Baron Kelly in Barnes *v.* Chipp, they are conditions precedent to the prosecution. I may observe also, that they are conditi ns which may easily be complied with. The objections above mentioned were raised by Mr. Warren at the close of the complainant's case, and on the evidence as it then stood. He afterwards relied upon the objection that the article was a perishable one, the defendant having sworn that it was so, and there being no evidence the other way. If the article was perishable, then it was admitted by the Town Clerk that the summons had not been served within the time prescribed by 42 and 43 Vic., c. 30 sec. 10. Unless I were to disregard all the usual rules of evidence I must hold, upon the evidence before me in this case, that the article is perishable, and upon this ground, therefore, the defendant is entitled to success. Some objects were taken by Mr. Warren to the form of the certificate of the analyst. I do not think it necessary to go into those objections excepting to say that the certificate in some points varies from the certificate given in the schedule to the Act, and that it is very desirable that in future cases, in order to avoid any question, it should not do so. Mr. Warren said he understood that the Town Clerk did not propose to go into the case of Robert Palmer, which was similar to that just decided. Mr. Bruce added that he thought the prosecution in this case might be of some value, because it had been shown by Mr. Wilcock's statement, and the statement of the shop-boy, that when a person went into a shop and asked for butter, he was supplied with butterine, which, when kept some time, became rancid.

We are requested to state that the experiments published by us, in our March number, on the Action of Permanganate of Potash, were made by a method suggested by Dr. Dupré, and which we understand he has used for many months.

RECENT CHEMICAL PATENTS.

The following specifications have been recently published, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

No. 1880	Name of Patentee.	Title of Patent.	Price.
3494	St. G. L. Fox	Electric Lamps	6d.
3509	J. Hopkinson	Electric Lamps	2d.
3540	J. Imray	Manufacturer of Sulphuric Acid	2d.
3550	F. A. Bonnefin	Preparing, Evaporating, &c., Saccharine Juices	4d.
3553	C. Weekes	Manufacture of Fuel	2d.
3554	E. Parry & T. H. Cobley	Manufacture of Earthy Silicates	2d.
3584	C. Hessel	Manufacture of Hydrogen, &c.	4d.
3592	W. Ayrton	Treatment of Bituminous Shales, &c.	4d.
3593	J. E. Newry and J. F. Ramsay	Manufacture of Yeast	4d.
3695	J. F. Parker	Manufacture of Gas	4d.
3730	A. Pope	Manufacture of Gas	8d.
3750	G. Wischin	Manufacture of Carbolic Acid	2d.
3771	H. Koenig	Manufacture of White Lead	2d

THE ANALYST.

JUNE, 1881.

SOCIETY OF PUBLIC ANALYSTS.

A General Meeting of the Society was held at Burlington House, on Wednesday, the 11th May. In the absence of the President, Mr. Heisch, the chair was taken by Dr. Dupré, F.R.S.

The minutes of the previous meeting were read and confirmed.

Dr. Vieth and Mr. Carpenter were appointed scrutineers to open the voting papers, and reported that the following gentlemen had been elected as members:—W. L. Emmerson, M.D., &c., Public Analyst for the County of Leicester, &c.; H. Meadows, M.B., Public Analyst for the Borough of Leicester; R. Oxland, F.C.S., Public Analyst for Plymouth and Devonport; W. F. K. Stock, Public Analyst for Durham.

The following gentlemen were proposed as members, and will be ballotted for on the 1st June inst.:—H. Leffman, M.D., Analytical Chemist, of Philadelphia; E. G. Love, Ph.D., Analytical Chemist, of New York.

Mr. Wigner referred to the table in The Analyst for May, and made some further remarks on the work done by Public Analysts during 1880 under the Sale of Food Act.

The following papers were then read and discussed:—

"On the Estimation of Tannin in Tea," by Dr. Alfred Hill.

"Note on the Isolation of Strychnine," and "Note on the Assay of Oils," by A. H. Allen.

It was announced that the next meeting, which had been fixed for the 1st June, had been specially set apart for the consideration of the Scale for the Valuation of Impurities in Drinking Waters, which has been in partial use by some of the Members of the Society who are co-operating in the scheme of water analyses, and that the subject would be introduced by a paper by Mr. Wigner.

ESTIMATION OF TANNIN IN TEA.

By Alfred Hill, M.D., F.I.C.

Read before the Society of Public Analysts, on 11th May, 1881.

In examining the later samples of tea which have been submitted to me for analysis, it occurred to me that it would be desirable to ascertain the quantity of tannin present, for although it has been already shown that this constituent of the tea leaf is very variable, and therefore that its quantity, unless large, is of little value as an indication of purity, or, unless very small, furnishes no proof of adulteration, yet a few more observations in the same direction may possibly be productive of some good.

I am not aware that Löwenthal's improved method of tannin estimation has ever been employed in the estimation of tannin in teas, and as its superiority to all other methods as regards expedition, ease and accuracy is testified to by the best authorities, I determined to employ it. It is regarded by Neubauer, Oser, Eitner, Kathreiner, and H. R. Procter, who have all had a large experience with it, and who have all helped to perfect it, as the best process for the estimation of tannin in barks and other similar materials, and it is therefore no doubt also best adapted for estimating the tannin in tea, in which, as in the tanning materials referred to, the tannin is associated with gallic acid and other substances which, like it and tannin, are readily oxidisable.

As some others may wish to use the method, it may perhaps be advantageous to say a few words in explanation of its principle and mode of application, but for fuller details I would refer to the author's original paper in the *Zeitschrift für Anal. Chemie*, 1877, pp. 33 and 201, to a paper by F. Kathreiner, Dingler's *Polyt. Journal*, No. 227, p. 481, and to two excellent papers by Mr. H. R. Procter, in the *Chemical News*, vol. xxxvi., p. 58, and vol. xxxvii., p. 256.

The principle of the process rests on the oxidisability in the cold of tannin and the associated compounds, the separation of the tannin by means of gelatine, salt and acid, and finally the oxidation of the associated compounds minus the tannin. The difference between the two quantities of the solution of potassium permanganate of known strength used in the oxidation processes is that necessary to oxidise the tannin alone.

The following are the solutions required :—

(1.) Solution of potassium permanganate, 1·333 grms per litre.
Of this solution, 24·1 c.c. = 0·063 grms. oxalic acid.
= 0·04157 grms. gallotannic acid (Neubauer).
= 0·062355 grms. quercitannic acid (Oser).

(2.) Solution of sulphindigotate of potassium of such strength that 20 c.c. require from, say 9 to 10 c.c. of the permanganate for oxidation.

(3.) Dilute sulphuric acid (1 to 3 water).

(4.) Gelatine solution made as follows: 12·5 grms. good transparent (pale) glue are steeped in cold water all night; the superfluous water is then poured off, and the dish containing the swollen gelatine placed on the water-bath to dissolve or melt the swollen mass, which is then saturated with good table salt and made up to 1 litre with a saturated solution of salt in water.

(5.) A saturated aqueous solution of salt containing either 25 c.c. sulphuric or 50 c.c. hydrochloric acid per litre.

The following is a description of my plan of proceeding:—2 grammes of tea were completely exhausted by boiling with water, and the decoction when cold was made up to 500 c.c., and the titration proceeded with at once in order to obviate any change. If the decoction must be kept even till next day Löwenthal recommends the addition to it of a few drops of glacial acetic acid (or of phosphoric acid).

10 c.c. of the decoction = 0·04 grm. of the tea leaf were taken, diluted with about a litre of water, mixed with 20 c.c. of the indigo solution and 10 c.c. of the sulphuric acid solution and the permanganate solution added very slowly and with constant stirring. The completion of the oxidation is recognised, if the titration be performed in a beaker placed on a white ground, by the occurrence of a clear yellow tint, readily hit by a little practice;

or, when the operation is conducted as recommended by Kathreiner in a white porcelain basin, by the appearance of a faint rose tint at the edge of the yellow liquid.

Having previously prepared another portion of the same decoction by removing from it the tannin, 50 c.c. of it are measured off and titrated with permanganate in precisely the same manner as just described. The mode of preparation is as follows:—100 c.c. of the decoction are mixed with 50 c.c. of the salted gelatine solution, and finally, after well stirring, with 100 c.c. of the salt acid solution. The tannin is thrown down in combination with gelatine, and, after standing several hours or all night, is filtered off; the filtrate should be *perfectly* clear. Care must be taken to mix the tannin solution with the solution of salted gelatine before adding the salt acid solution; because, as Löwenthal especially mentions, acids precipitate, partly at least, the salted gelatine.

The time occupied by the titration of the original decoction should not be less than four minutes, and by that of the filtrate from the tannate of gelatine six minutes, as the presence of gelatine exerts a retarding influence on the reaction.

The following is a transcript from my note book of the results of an actual experiment:—

A.—Tannin and other Oxidisable Matters.

10 c.c. decoction = 0·04 grm. tea ... ... 20 c.c. indigo solution acidified	required	13·2	c.c.	permanganate.
Ditto repeated	,,	13·0	,,	,,
		26·2		
40 c.c. indigo alone, acidified	,,	19·8	,,	,,
20 c.c. = 0·08 grm. tea	,,	6·4	,,	,,

B.—Oxidisable Matters Exclusive of Tannin.

50 c.c. filtrate = 0·08 grm. tea ... ... 20 c.c. indigo solution, acidified	required	11·8	c.c.	permanganate.
Ditto repeated	,,	12·0	,,	,,
		23·8		
40 c.c. indigo alone, acidified	,,	19·8	,,	,,
100 c.c. = 0·16 grm. tea	,,	4·0	,,	,,

$6·4 \times 2 = 12·8$ c.c.

4·0

8·8 c.c. permanganate required by tannin in 0·16 grm. tea.

$8·8 \times 0·0026 = 0·02288$

$$\frac{·02288}{·16} = ·143 \text{ grm. or } 14·3 \text{ per cent. tannin.}$$

The calculation is based on Rochleder's statement that the peculiar tannin of tea is identical with quercitannic acid, and on the employment of Oser's factor for that acid.

In order to save others trouble I may take this opportunity of pointing out what is evidently an error of inadvertence in the statement following the example quoted from Löwenthal's original monograph by Mr. Procter in the *Chemical News*, vol. xxxvi., pp. 59 and 60, and that Mr. Wynter Blyth, in his *Manual of Practical Chemistry*, has copied the error. Mr. Procter has omitted to divide the figures 9·1 by 2, the result of which is that 10·8 c.c. permanganate are made to appear as equivalent to the tannin of

20 c.c. of the sumach decoction or to 0·2 grm. of dry sumach, whereas the quantity of permanganate required is actually 15·35 c.c.

The last eight samples on the list I obtained from a large importer who gave me the particulars of description, and their genuineness as imported is undoubted.

Green teas as a rule contain more tannin than black teas, but there are many exceptions, as a reference to the list will show, and it is remarkable that the sample of black tea containing the largest quantity of tannin (No. 31) contains more than the richest sample of green (No. 8).

Mulder found 17·8 per cent. in Chinese green tea (Hyson), and 12·88 per cent. in Chinese black tea (Congo) ; also 17·56 per cent. in Java (Hyson), and 14·8 per cent. in Java (Congo).

The average amount of tannin in the thirty-two samples, the analyses of which I submit, is 14·8. Mulder's results were obtained with dried tea, mine with undried, so that his average results and mine are very similar. Some results obtained by Mr. Wigner, and given in the *Proceedings of the Society of Public Analysts*, vol. i., p. 235, are very much higher than any I obtained, probably because the method of estimation employed was that by acetate of lead, which includes gallic as well as tannic acid.

The amount of tannin in tea is seen not to be in proportion to price, while in astringents used for tanning it is so ; the esteem in which a tea is held seems to depend upon qualities appreciable by the taster rather than upon chemical composition as revealed to the chemist. It is desirable that in the examination of teas, as in that of other matters, uniformity of procedure should be observed, so that the results of different experimenters may admit of comparison, which is impossible as long as one uses the gelatine process, another the acetate of lead method, and a third that of Löwenthal. As the latter is now much simplified and is comparatively easy, quick and certain, while it gives the amount of tannin as distinguished from gallic acid, I trust that others will be induced by my own experience of the process to give it a trial when a suitable opportunity shall present.

RESULTS OF TEA ANALYSIS.

Description.	Ash Total.	Ash Soluble.	Ash Insoluble.	Tannin.	Extract.
Mixed	6·06	3·50	2·56	15·93	—
Mixed	5·98	3·78	2·20	16·57	35·5
Black	7·00	3·34	3·66	7·80	28·00
Mixed	6·08	3·64	2·44	11·05	33·25
Mixed	6·69	3·41	3·28	17·55	36·25
Mixed	5·88	3·56	2·32	12·35	34·25
Black	5·77	4·24	1·53	13·65	35·50
Green	6·69	4·20	2·49	24·98	43·00
Black	6·08	3·86	2·22	12·35	33·50
Green	6·06	4·14	1·92	20·80	43·00
Green	5·81	4·01	1·80	24·05	43·75
Black	6·34	3·90	2·44	12·35	34·00
Black	6·21	3·59	2·62	15·02	29·80
Green	5·98	4·34	1·64	21·13	39·00
Black	6·90	3·46	3·44	8·13	26·50
Green	5·92	3·86	2·06	19·60	33·00
Black	6·71	3·05	3·66	10·08	28·75
Green	6·94	3·31	3·63	9·10	25·50
—	6·06	3·52	2·54	15·28	—

RESULTS OF TEA ANALYSIS.—*Continued.*

Description.	Ash Total.	Ash Soluble.	Ash Insoluble.	Tannin.	Extract.
——	6·50	3·72	2·78	14·30	——
——	5·83	3·05	2·78	8·13	——
——	5·88	3·94	1·94	17·88	——
——	6·08	3·44	2·64	9·10	——
——	6·78	3·50	3·28	14·63	——
Medium Congou, Chinese (Black), cost total 2/0½, June 4th, 1880 ..	5·90	3·44	2·46	6·83	——
Assam (Black), cost total 2/2, June 4th, 1880	5·55	3·18	2·37	6·18	——
Common Chinese Congou (Black), cost total 1/4½, June 4th, 1880 ..	5·83	3·08	2·75	7.45	——
Finest Assam (Black), cost total 4/2, June 4th, 1880	5·30	3·92	1·38	18·85	——
Very Fine Gunpowder (Green), cost total 3/11, June 4th, 1880 ..	7·10	3·88	3·22	20·05	——
Common Gunpowder (Green), cost total 1/8, June 4th, 1880	6·16	4·00	2·16	18·50	——
Caper Tea (Black), cost total 2/0, June 4th, 1880	5·58	3·92	1·66	26·90	——
S. O. Pekoe (Black), cost total 2/4, June 4th, 1880	5·78	3·53	2·25	16·60	——
Averages	6·17	3·67	2·50	14·79	34·27

SWEDISH LAWS AFFECTING SALE OF POISONS.

BY C. HEISCH, F.C.S., F.I.C.

Read before the Society of Public Analysts, on March 16th, 1881.

[CONCLUDED.]

PROCLAMATION BY ROYAL BOARD OF HEALTH OF STOCKHOLM, 28th February, 1876.

After a long preamble it gives a catalogue.

First.—Of poisonous matters which may only be sold by druggists, or chemical manufacturers who have prepared them, and only in conformity with rules laid down in Decree of January 6th.—Amygdalin, Chloride of Antimony, Metallic Arsenic, Arsenic Acid, Arseniate of Soda, and all Arsenical Salts other than painters' colours; Arsenite of Potash and other Arsenites not being painters' colours; Atropin and its Salts; Oil of Bitter Almonds, containing Prussic Acid; Cyanide of Potassium, and Cyan. Salt, which is mixture of KCy and NaCy; Prussic Acid; all Cyanides, except those containing Iron, such as Red and Yellow Prussiate of Potash, Prussian Blue, &c.; Digitalin, Phosphorus, Chloral Hydrate, Chloroform, Koniin and Salts; Tartar Emetic, Antimonial Wine, Antimoniate of Potash, and Emetic Salts in general; all Bases extracted from Opium and Salts appertaining thereto; Nicotine and Salts; Picrotoxin; all Mercurial Salts, Oxide, Chloride, and Sublimate; Strychnia; Brucia and Salts; Sulphides of Arsenic, Orpiment, Realgar, &c.; Oil of Sabine and other preparations; Veratrin and Salts; Vegetable Alkaloids, other than above; Aconite, Colchicin, Sabadillin, &c., with their Salts or corresponding Extracts; Belladonna Leaf, Root, or Extract; Bitter Almond Water, Extract Henbane, Prussic Acid Emulsion, Curare and Urare Poisons; Digitalis Leaf, Extract, and Tincture; Elaterium; Ignatius

Bean; Indian Hemp or Extract; Kalabar Bean; Cocculus Indicus; Croton Seeds or Oil; Mezereon; Lactucarium; Laurel Water; Lobelia Herb and Tincture; Secale and preparations; Conium and preparations; all preparations of Opium, Euphorbium, Veratrin, Hellebore, Nux Vomica, Sabadilla; Scammony; Cantharides and Extract, &c.; Stramonium; Staphisagria; Aconite Root, Leaf, or Extract; Colchicum and preparations.

Second.—Such poisons as may be sold by licensed dealers according to rules in Decree of January 6th.—Ammonia, Aniline, Baryta Salts, Litharge, Red Lead, Sugar of Lead, Strong Oil of Vitriol, Sulphates of Copper and Iron, Oxalic Acid, Salts of Sorrel, Ink Powder, Caustic Potash and Solution, Chloride of Zinc, and Chloride of Zinc and Ammonia, Bisulphide Carbon, Blue Vitriol, Blue Stone, Oxide Copper, Chromic Acid Oxide and Salts, Caustic Soda and Solution, Nitro-benzol, Mirbane Oil, Imitation Oil of Bitter Almonds, Oxalic Acid, Nitric Acid, Muriatic Acid, Nitrate and Oxide of Silver, Salts of Tin and Zinc, Concentrated Acetic Acid. Poisonous colours, containing Zinc, Cadmium, Bismuth, Tin, Chromic Acid, Antimony, Lead, Copper, Mercury, and Arsenic. Those most usually used are mentioned, but all cannot be specified.

White Colours.

White Lead, Hamburg White, Dutch White, Pearl White, Silver White, Slate White, Spanish White, Tin White, Venetian White, Bismuth White, Zinc White.

Grey and Black Colours.

Lead Black, Iron Black, Copper Black, Black Cinnabar, Zinc Grey, all Coal Tar Grey and Black Colours when they contain arsenic, copper or other poisonous material.

Red and Orange Colours.

Red Sulphide of Antimony, Red Lead, Realgar, Cinnabar, Vermilion, Orange Chrome, Red Chrome, Minium, Paris Red, Red Varnish Paints, Amarin, Berlin, Viennese and Fenambruck Reds, Sap Red, &c. Red and Yellow Tar Colours when they contain arsenic or other poisonous ingredients.

Yellow Colours.

Antimony Yellow, Baryta Yellow, Cadmium Yellow, Lemon Chrome, Yellow Ultramarine, Gamboge, Hamburg Yellow, Jaune Brilliant, Kassel Yellow, Imperial Yellow, Cologne Yellow, Chrome Yellow, Leipsic Yellow, Massicot, Mengel Yellow, Mineral Yellow, Neapolitan Yellow, New Yellow, Patent Yellow, Permanent Yellow, Picric Acid, Siderin Yellow, Steinbuhl Yellow, Verona Yellow, Zinc Yellow and Zinc Chrome, Brass Lacquer made with metallic salts. All Yellow Tar Colours which contain arsenic or any poisonous ingredients, Orpiment, and all Sulphides of Arsenic.

Blue and Violet Colours.

Azure Blue, Celestial Blue, Bremen Blue, Cerulian Blue, Sky Blue, Chalk Blue, Cobalt Ultramarine, Cobalt Violet, Copper Blue (blue verditer), King's Blue, Mineral Blue, Neuberg Blue, Smalt, Thenand's Blue, Violet, Lac and Zinc Blue. All Blue Tar Colours containing arsenic or other poisonous substances.

Green Colours.

Azure Green, Brunswick, Bremen, Cassilman's, Elsners and Cinnabar Greens, English, Ground, Cassel's, Imperial and Cherryhill Greens, Cobalt Greens, Chrome, May, Mineral Moss, Neuwied's, New, Original, Parrot, Paris and Permanent Greens (Pickel and Reseda), Rinmon's, Scheele's, Schweinfurt, Swiss, Emerald, Spanish, Turkish, Vienna, Victoria,

Wurzburg, Zinc and Verdigris, Green and all Green Tar Colours containing arsenic or other poisonous ingredients.

BROWN COLOURS.

Hatchett's, Chemical and Copper Browns, Copper Red Brown, Bismuth Brown, and all Brown Tar Colours, containing arsenic or other poisonous ingredients.

It is remarkable that all Coal Tar Colours contain ing arsenic or other poisonous matters, are but no hint is given that any are in themselves deleterious.

This very important sentence follows the list of colours :—

Regarding the existence of arsenic in colours or paints, it has hitherto been supposed that this substance is found only in copper green colours. It is now known to exist in many other colours, amongst which are some of the brightest reds which are supposed to be heightened in brilliancy by arsenic. This poison is also found in many grey colours employed in the manufacture of paperhangings; also in Aniline colours which have been carelessly purified. In these arsenic would not be suspected, and can only be found by chemical process.

List of articles which may be used to colour confectionery :—

WHITE COLOURS.

Chalk, Starch (Potato or Arrowroot).

BLACK COLOURS.

Ivory Black, Lamp Black, Charcoal Soot, Indian Ink.

RED COLOURS.

(In Decree all Mercurial Salts are prohibited).

Carmine, Vermilion, Cochineal, Red Sandal, Brazil Wood, Currant Juice, Alkanet, Raspberry, Barberry, Saffron.

YELLOW COLOURS.

Saffron, Turmeric, Annatto, Quercitron, Quassia, Marigold, Persian Berries.

BLUE AND VIOLET COLOURS.

Clean Ultramarine, Indigo, Archil, Purple Iris, Logwood, Wormwood Flowers, Bilberry, Elderberry, Sloes, Black Cherry, Mulberry, Black Currant.

GREEN COLOURS.

Spinach, Pistacio, or any of the above named yellows and blues mixed.

BROWN COLOURS.

Burnt Sugar, Coffee, Catechu, Chino, Liquorice.

METALS.

Gold and Silver Leaf, pure.

The absolute prohibition of the sale of all paperhangings, &c., containing arsenic having been found oppresive to tradesmen, in November, 1879, the following definition of what was to be considered arsenical within the meaning of the Decree was published :

No paperhangings to be sold if a piece of 50 Swedish square inches (68·2 English square inches) or less can by chemical means have produced from it metallic arsenic sufficient to produce a black or brown mirror in a glass tube 2 millimetres (·0~~1~~ 8 inch English) internal diameter.

Textile fabrics, lamp shades, &c., if 25 Swedish square inches show similar mirror.

Candles, Sealing Wax, &c., if a sample weighing 5 Swedish orts (385·8 grs. English) can be made to show similar mirror.

Chemists employed, to give certificates under hand and seal, accompanied by an hermetically sealed tube containing the mirror obtained as above, and also a piece of the paper, &c., large enough to identify it with the original goods, and to enable a further analysis to be made, in case of dispute, and shall be accompanied also by a certificate from the analyst that all his chemicals were duly tried by him and found free from arsenic.

To come into force on 1st July, 1880.

It is to be regretted that no more definite directions as to the productions of this mirror are given, or how much arsenic per piece of paper it is supposed to represent, as differences would be pretty sure to arise amongst analysts as to the meaning of a black or brown mirror, &c.

ON MAUMENÉ'S TEST FOR OILS.

By Alfred H. Allen.

Read before the Society of Public Analysts on 11th May, 1881.

Some years ago M. Maumené published a method of testing oils which was dependent on the rise of temperature observed on mixing a known weight of the sample with a definite amount of strong sulphuric acid. The value of the principle has been confirmed by observers, who have also proved the approximate constancy of the results obtained.

Maumené's experiments were made by mixing 50 grammes of the oil with 10 c.c. (= 18·45 grammes) of concentrated sulphuric acid in a beaker, or large test tube,* stirring the mixture with a thermometer, and noting the greatest rise of temperature produced.

Fehling, and, under his direction Faisst and Knauss, operated in an exactly similar manner, but they employed 15 grammes of oil to 5 grammes of acid. In the latter mode of manipulating, the temperature obtained is somewhat less elevated, owing to the greater proportional loss by conduction and radiation. The acid should be gradually added from a burette or pipette, while the mixture is continuously stirred with the thermometer.

The following figures show in a tabular form the rise in temperature observed by Maumené and Fehling respectively, when working the manner already described† :—

Kind of Oil.	Rise of Temperature Observed. Maumené. °C.	Fehling. °C.
Castor	47	
Olive	42	37·7
Sweet Almond	52·5 to 53·5	40·3
Bitter Almond	52	
Rape	57 to 58	55
Colza Rape	58	
Arachis (Earth-nut)	67	
Beech-nut	65	
Sesamé	68	
Poppy-seed	74·5	70·5
Hemp-seed	98	
Walnut	101	
Linseed	103	
Cod-liver	102 to 103	
Skate-liver	102	
Horse-foot	51·5	
Tallow oil	41 to 43·5	

* In the case of linseed oil, and other oils giving much heat, it is necessary to use a somewhat tall beaker, as the mixture swells greatly owing to the gas generated.

† My excuse for re-publishing in detail the results of other chemists is that many of the figures given in the test have not, to my knowledge, hitherto found their way into any English journal or book, and have not previously been correlated.

The original figures of Maumené have been recently verified and added to by him, and those of Fehling have been confirmed by other observers, especially in the case of olive oil. Thus: MM. Faisst and Knauss, employing Fehling's proportions, observed a rise of 38° C. in the case of pure olive oil, whilst with poppy-seed oil the rise was not less than 70° C. In mixtures of the two oils, the *additional* rise of temperature was regularly 1·6° C. for every 5 per cent. of the adulterant.

Nearly all fatty oils, except oil of ben, and tallow and lard oils, produce a higher rise of temperature than olive oil, so that an excessive increase is a valuable indication of admixture, and even of its approximate extent.

The results of Maumené and Fehling appeared so important that I thought it unfortunate that the list of oils examined by them was deficient in certain important respects. With a view of verifying their results, and of extending them in certain respects, I have made a series of experiments by the same method, using in each case 50 grammes of the sample and 10 c.c. of sulphuric acid of 1·845 specific gravity. The following table shows the results obtained:—

Kind of Oil.	Specific Gravity at 15·5° C.	Rise of Temperature. °C.
1. Olive Oil, believed to be genuine	·9144	42
2. Best Salad Oil	·9156	38, 39, 39
3. Rape Oil, Brown, German	·9176	51, 55.
4. „ German	·9172	50·5
5. „ Brown, East Indian	·9166	54·5
6. „ East Indian	·9157	56·0
7. Cotton Seed Oil	·9285	60·5
8. „ „	·9283	57, 59
9. Niger Seed Oil	·9267	81
10. Linseed Oil, East Indian	·9326	109
11. „ Baltic	·9317	109
12. „ Baltic	·9341	110, 111
13. Cod Liver Oil, pale	·9270	113
14. Sperm Oil, genuine	·8811	45
15. „ genuine, finest	·8778	46
16. „ believed to be genuine	·8826	45
17. Russian "Oleo-naphtha"	·9050	3
18. Mineral Lubricating Oil	·8921	3
19. Shale Lubricating Oil	·8894	4
20. Rosin Oil	·9739	19

The oils from 3 to 12, inclusive, were obtained direct from the seed-crushers, and were certainly genuine. I have every confidence that the fish oils also were perfectly genuine and representative samples.

On the whole, the above results confirm the value of Maumené's method, and in some cases his observations also, but in other respects there are rather marked discrepancies.

It will be observed that the rise of temperature I obtained in the case of olive oil is exactly identical with the observation of Maumené. The salad oil, No. 2, which was of questionable origin, gave somewhat lower results in each of three determinations. Hence, it is difficult to suppose that the sample was otherwise than genuine.

In the case of rape oil, it will be noticed that the two samples of German rape gave sensibly less heat than the East Indian samples, while these last scarcely rose to the temperature observed by Maumené.

On the other hand, the results obtained by me from three samples of linseed oil are all higher than that of Maumené, and the same remark applies to the rise of temperature obtained with cod-liver oil.

It will be observed that the hydrocarbon oils produce much less heat on treatment with sulphuric acid, and that rosin oil is itself sharply distinguished from the shale and petroleum products.

Maumené, in a very recent paper,* states that: "Recently heated acid, without having lost the least trace of water, presents very different actions, at least so far as the disengagement of heat which accompanies them, from those produced by the same acid long prepared. The contradiction of this great fact by M. Berthelot does not appear to me to be well founded."

I am not quite clear what strength of acid Maumené employed, as I am unable to comprehend the term "l'acide ordinaire à 83·5° densimetriques." It may mean either acid of 1·835 specific gravity, or acid containing 83·5 per cent. of SO_3. Maumené compares the temperatures produced by using this acid, with those obtained with the same acid recently heated to 320°, cooled, and employed at the ordinary temperature. With 5 c.c. of these acids, and 25 grammes of various samples of linseed oil (half the original quantities), Maumené obtained such results as 66° and 148°; 55° and 133°; 59° and 146°.

With a view of confirming these interesting results, I have ascertained the heat evolved by mixing 50 grammes of certain of the oils in the foregoing list with 10 c.c. of the same acid previously used, but which had been heated to boiling and partially evaporated in platinum, then cooled to the ordinary temperature, and used without delay. The following are the results:—

No.	Kind of Oil.	Increase of Temperature, °C. With old acid.	With recently boiled acid.
2	Best Salad Oil	38, 39, 39	39·5
3	Rape Oil	51, 55	52
4	Rape Oil	50·5	51
10	Linseed Oil	109	108
11	Linseed Oil	109	110
12	Linseed Oil	110, 111	111

These results offer a direct contradiction to those of M. Maumené. They might be extended, but in the face of the almost absolute agreement between the temperatures produced by the two acids, there is not much encouragement to pursue the matter farther. I can suggest no explanation of M. Maumené's results, unless it be that his acid really increased in strength by the heating, in opposition to his express statement to the contrary. A comparatively slight variation in the strength of the acid used certainly causes a notable difference in the rise of temperature.† I suspect on several grounds that the concentrated sulphuric acid used in France is not always of full strength.

Maumené concludes his paper by stating that he maintains, in contradiction to M. Berthelot, that recently heated sulphuric acid gives different temperatures when mixed with water from that produced by old acid. On mixing 10 c.c of each of the acids used for the oil experiments with 20 c.c. of water, I found the rise of temperature to be respectively 81° and 82° C.

I am indebted to Mr. Charles Harrison for the very careful manner in which, under my direction, he has made most of the experiments the results of which are recorded in this paper.

* "Sur l'action de l'acide sulphurique récemment chauffée à 320° et les huiles."—*Comptes Rendus*, March 21st, 1881, page 721.

† It would perhaps be a wise precaution always to employ recently boiled acid, so as to ensure its being of full strength.

SOURCES OF THE PUBLIC WATER SUPPLIES OF ENGLAND.

Darlington, Stockton and Middlesbrough.—The water supplied to the three towns is identical in composition. It is obtained from the river Tees, which rises in Crossfell, in Cumberland. The gathering grounds are mainly peaty moorlands. The bed of the river is chiefly composed of carboniferous limestone. Down to the pumping station the river is shallow and has a rapid flow over rock and shingle. In its course it receives two important tributary streams—the Lune and the Balder. It also receives the sewage of Middleton-in-Teesdale, Barnard Castle and Gainford, which have an aggregate population of about 8,000. The pumping stations are at Broken Scar, 2½ miles west of Darlington. The water is lifted into settling ponds, thence to filter beds of ordinary construction. Speaking of Darlington itself the filters somewhat lack efficiency, for in flood time the water is seldom free from turbidity. There are practically no storage reservoirs. There are small reservoirs attached to each works, which hold about enough for one day's consumption, so that the supply is really continuous. The works are in the hands of the Corporation of Darlington, and a Joint Water Board for Stockton and Middlesbrough.

Ipswich has two water supplies, a high and a low service. The high service supply is obtained from an artesian well in Waterworks Street, having a bore 15 inches in diameter, and a depth of 112 feet into the chalk. 400,000 gallons are pumped daily into mains which supply the higher parts of the town. The low service supply is surface water obtained from gathering grounds at Holy Wells, Burk's Hill, and Christchurch Park, and stored in reservoirs. This water supplies the lower parts of the town. In cases of fire the high service can be turned on to the low service pipes.

CORRESPONDENCE.

[The Editors are not responsible for the opinions of their Correspondents.]

THE WATER SUPPLY OF PHILADELPHIA, U.S.A.

TO THE EDITOR OF "THE ANALYST."

SIR,—I send herewith the report of the analysis of a sample of water taken during last week in April.

SCHUYLKILL WATER.

Colour in 2ft. tube	Very slightly yellow.
Smell at 100°F.	None.
Chlorine	0·53
Phosphoric Acid	None.
Nitrogen as Nitrates and Nitrites	0·0412
Oxygen absorbed in two minutes at 80° F.	None.
,, ,, ,, four hours	0·0701
Hardness before boiling	4·5°
,, after ,,	4·5°
Free Ammonia	None.
Albuminoid Ammonia	0·0091
Total Solids	7·01
Sediment	Vegetable debris with siliceous matter.

HENRY LEFFMAN, M.D.

920, Walnut Street, Philadelphia, May 5th, 1881.

Analyses of English Public Water Supplies in May, 1881. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Date when drawn.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine in Chlorides.	Phosphoric Acid in Phosphates.	Nitrogen in Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in: 2 mins. at 80° Fahr.	Oxygen, Absorbed in: 4 hours at 80° Fahr.	Hardness, Clark's Scale, in degrees: Before Boiling.	Hardness, Clark's Scale, in degrees: After Boiling.	Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
Kent Co.	May 17	c. p. blue	none	1·92	traces	·740	none	·0022	·0060	·0120	22·2°	8·3°	34·00	satisfactory	Wigner & Harland.
New River	„ 18	clear v. f. yellow	none	1·01	none	·161	·0014	·0035	·0042	·0560	13·6°	3·2°	17·92	satisfactory	B. Dyer.
East London ..	„ 16	c. green yellow	none	1·34	traces	·245	·0002	·0023	none	·0310	12·6°	5·1°	20·00	veg. deb. fib. mycel. anim.	Wigner & Harland.
Southwark & Vauxhall ..	„ 9	v. p. green. yelw.	none	·96	trace	·120	·0012	·0051	·0040	·0537	14·0°	3·0°	19·64	mnl. diams. few infusoria	J. Muter.
West Middlesex	„ 10	yellowish	none	1·04	trace	·180	·0007	·0020	none	·0400	13·5°	3·5°	18·37	satisfactory	O. Hehner.
Grand Junction		p. yellow	none	1·06	trace	·121	·0006	·0039	·0064	·0380	13·3°	3·8°	19·40	no deposit	A. Wynter-Blyth.
Lambeth	„ 11	v. p. green. yelw.	none	·99	trace	·140	·0014	·0040	·0022	·0530	14·0°	3·0°	19·80	s. mineral and diatoms	J. Muter.
Chelsea	„ 7	c. p. green. brn.	none	·89	trace	·080	·0010	·0035	·0030	·0390	13·0°	3·0°	17·64	good	A. Dupré.
Bath	May 12	c. f. blue	none	1·01	none	·077	none	·0007	none	none	16·0°	4·5°	19·20	no deposit	J. W. Gatehouse.
Birmingham ..	„ 3	turbid greenish	none	1·47	traces	·231	·0020		·0070	·0350	8·7°	4·5°	16·95	vegetable matter	A. Hill.
Bradford	„ 16	s. yellow opaque	none	·75	none	none	·0007	·0063	·0300	·1700	4·0°	3·7°	7·20	no deposit	F. M. Rimmington.
Brighton	„ 9	c. p. green ylw.	slight	2·00	traces	·508	·0011	·0013	none	none	14·0°	3·0°	23·40	vegetable debris	Wigner & Harland.
Bristol	„ 3	brownish green	none	·90	none	·070	none	·0049	·0021	·0280	14·0°	1·7°	20·80	sand	F. W. Stoddart.
Cambridge	„ 9	c. pale blue	none	1·40	h. trace	·560	·0021	·0021	·0039	·0448	18·8°	6·4°	25·90	satisfactory	J. West-Knights.
Canterbury	„ 14	pale blue	none	1·47	none	·338	·0005	·0006	·0050	·0130	8·5°	4·0°	14·28	v. s. mineral	S. Harvey.
Croydon	„ 18	bright colourless	none	1·12	trace	·340	none	·0010	none	·0080	15·5°	9·0°	25·60	no deposit	C. Heisch.
Coventry	„ 18	f. yellow	none	1·50	traces	·163	none	·0105	·0010	·0430	17·4°	6·1°	30·60	sand	H. Swete.
Darlington	April 26	yellow s. turbid	none	·70	trace	·017	trace	·0028	·0070	·1220	5·6°	5·2°	10·36	satisfactory	W. F. K. Stock.
Derby	May 16	v. good	none	·90	trace	·075	·0007	·0010	none	·0027	11·1°	4·4°	16·59	satisfactory	L. Archbutt.
Droitwich	„ 17	blue	none	2·40	none	·141	none	·0007	·0014	·0307	33·2°	19·4°	55·18	satisfactory	H. Swete.
Dublin	April 26	s. yellow	none	·79	traces	traces	·0020	·0075	none	·0500	1·5°	1·0°	4·60	satisfactory	C. A. Cameron.
Dudley	May 14	f. green	none	1·30	none	·341	none	·0028	·0110	·1834	17·0°	10·0°	24·08	vegetable debris	H. Swete.
Edinburgh	„ 16	f. brown	none	·78	none	v.f. trc.	·0008	·0048	·0096	·0284	3·7°	3·2°	5·52	none	J. Falconer King.
Exeter	„ 8	f. greenish yelw.	none	·91	trace	·114	·0007	·0036	none	·0379	2·9°	2·9°	6·30	none	F. P. Perkins.
Greenock	April 23	light brown	none	1·02	none	·002	·0056	·0077	·0500	·2500	1·9°	1·5°	4·90		J. W. Biggart.
Grantham	May 8	c. pale blue	none	·84	trace	·490	·0006	·0014	none	·0185	15·3°	4·4°	22·17	diams. min. mvg. orgs	A. Ashby.
Huddersfield ..	„ 14	c. s. brwn. yelw.	none	·60	trace	·010	none	·0042	·0040	·0300	2·0°	2·0°	5·20	peaty matter	G. Jarmain.
Hull	„	good	none	1·20	trace	·237	·0043	·0027	·0025	·0030	15·0°	3·5°	20·26	satisfactory	J. Baynes, Jun.
Ipswich	„ 14	c. colourless	none	2·12	trace	·190	·0030	·0042	none	·0087	19·2°	8·4°	29·92	satisfactory	J. Napier.
King's Lynn ..	„ 9	milky white	veg. mttr.	1·71	h. traces	·204	·0028	·0119	·0252	·2800	14·6°	4·4°	21·00	diatoms bacteria	W. Johnstone.

Analyses of English Public Water Supplies in May, 1881. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Date when drawn.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine in Chlorides.	Phosphoric Acid in Phosphates.	Nitrogen in Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in 2 mins. at 80° Fahr.	Oxygen, Absorbed in 4 hours at 80° Fahr.	Hardness, Clark's Scale, in degrees. Before Boiling.	Hardness, Clark's Scale, in degrees. After Boiling.	Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
Leeds	May 17	yellowish brown	none	·74	trace	none	·0003	·0031	·0140	·1344	3·6°	3·0°	5·04	peaty matter	T. Fairley.
Leicester	„ 18	v. s. yellow	none	1·25	trace	·140	·0020	·0033	·0030	·0750	7·30°	4·4°	14·66	satisfactory	W. L. Emmerson.
Liverpool	„ 17	greenish yellow	peaty	1·08	traces	·077	·0028	·0042	·0056	·0912	4·6°	4·4°	8·40	satisfactory	A. Smetham.
Llandrindod	„ 17	blue	none	1·20	none	·086	none	none	·0005	·0120	10·2°	6·2°	10·90	satisfactory	H. Swete.
Maidstone—															
Wtr. Company	„ 18	clear	none	2·30	trace	·707	none	none	·0028	·0305	17·5°	7·9°	34·75	none	M. A. Adams.
Public Conduit	„ 18	clear	none	2·50	trace	·611	none	·0007	·0028	·0274	17·5°	8·3°	33·88	none	M. A. Adams.
Manchester	„ 13	c. s. yellowish	none	·86	none	none	·0029	·0042	·0108	·0602	1·7°	1·6°	5·257	mineral sediment	W. Thomson.
Newark	„ 7	bl. grn. s. turbid	none	1·26	trace	·050	·0009	·0043	none	·0155	16·1°	8·5°	32·42	few diams. & mvg. orgms.	A. Ashby.
Newcastle-on-Tyne	„ 8	f. yellow	none	·88	trace	·048	·0010	·0080	·0050	·0880	15·1°	5·5°	18·40	satisfactory	J. Pattinson.
Nottingham	„ 19	p. c. blue	none	1·78	traces	1·295	·0006	·0058	none	·0074	18·0°	10·2°	24·80	fibrs. veg. deb. diams. hair	Wigner & Harland.
Northampton	„ 14	v. p. yellow	none	5·50	traces	·611	none	·0014	·0007	·0460	13·2°	6·5°	55·24	satisfactory	H. Swete.
Norwich	„ 12	s. greenish yelw.	none	1·90	traces	·547	traces	·0044	·0280	·0694	8·5°	2·5°	9·20	satisfactory	W. G. Crook.
Oldham	„ 10	s. turbid yellow	none	·85	traces	·019	·0078	·0025	·0008	·0060	4·0°	3·6°	5·06	satisfactory	C. Estcourt.
Portsmouth	„ 10	clear	none	1·03	trace	·200	trace	·0021	none	none	14·7°	3·7°	20·40	vegetable deb. decayed	W. J. Sykes.
Reading	„ 11	c. bluish	none	·88	none	·110	·0005	·0045	·0030	·0350	14·4°	4·3°	18·35	satisfactory	J. Shea.
Rochdale	„ 15	pale blue	none	·50	none	·006	·0020	.0030	·0016	·0300	3·6°	1·5°	4·90	satisfactory	T. A. Collinge.
Rugby	„ 7	v. turbid	none	·84	h. traces	·287	·0105	·0070	·0123	·0313	11·0°	5·5°	17·50	veg. deb. diatms. bacteria	A. P. Smith.
Salford	„ 9	c. yellow	none	·60	none	none	·0028	·0035	·0140	·0190	2·5°	2·0°	5·00	none	J. Carter Bell.
Sheffield	„ 17	brown turbid	none	·40	none	none	·0028	·0056	none	·0630	4·8°	4·8°	4·97	satisfactory	A. H. Allen.
Shrewsbury	„ 6	c. colourless	none	1·50	traces	·300	none	·0015	none	none	22·8°	3·7°	25·00	no deposit	T. P. Blunt.
Southampton	„ 16	greenish yellow	sligt. weedy	·99	h. traces	·184	·0016	·0049	·0070	·0770	12·5°	4·5°	19·90	vegetable debris	A. Angell.
Stockport	„ 12	v. s. turbid	none	1·02	h. traces	·031	·0022	·0028	·0012	·0060	4·8°	3·8°	6·44	satisfactory	C. Estcourt.
Stourbridge	„ 14	blue	none	3·00	none	·910	·0007	·0042	·0046	·0932	21·0°	7·2°	36·10	satisfactory	H. Swete.
Stourport	„ 14	f. blue	none	1·50	none	·191	none	·0035	·0018	·0692	14·0°	6·8°	21·14	sand	H. Swete.
Sunderland	„ 16	c. colourless	none	2·00	trace	·280	·0023	·0030	·0020	none	9·6°	3·7°	25·00	vegetable debris	H. J. Yeld.
Swansea	„ 16	s. turbid	none	1·00	trace	none	·0007	·0056	·0030	·0040	3·0°	2·5°	4·27	earthy matter	W. Morgan.
Warwick	„ 9	greenish	none	1·19	none	.700	·0007	·0035	·0140	·0410	19·2°	11·0°	23·80	none	A. B. Hill.
Whitehaven	„ 5	c. f. green	none	·38	none	·012	none	·0007	none	·0125	·4°	·4°	2·19	vegetable deb. diatoms	A. Kitchin.
Wolverhampton	„ 14	yellowish tinge	none	1·33	h. traces	·124	none	0063	·0013	·0680	12·6°	5·2°	19·88	desmids and diatoms	E. W. T. Jones.
Worcester	„ 12	v. p. yellow	none	3·10	traces	·075	none	·0049	·0031	·1532	11·3°	7·7°	18·20	vegetable debris	H. Swete.

Abbreviations:—c., clear; f., faint; h., heavy; p., pale; v. h., very heavy; v. s., very slight.

ERRATA.—In the March Table the Nitrates in the CHELSEA water should have been ·1400 instead of ·5300.
In the April Table the Oxygen of the BIRMINGHAM water absorbed in 4 hours should have been ·035 instead of ·305.
In the April Table the Hardness before boiling in the CAMBRIDGE water should have been 19·0° instead of ·2°.

SALE OF FOOD ACT IN SCOTLAND.

To the Editor of "The Analyst."

Sir,—I fear the working of the "Act" will not be of much advantage, in some places, at least, until a clause is introduced making it compulsory on all Burghs, &c., who appoint an Analyst, to take a certain number of samples every year, the number to be in proportion to the population. A short time ago I addressed a letter to the Town Clerks of several towns for which I am Analyst, directing attention to the fact that nothing whatever had been done in the way of carrying out the Act. These letters have been read at the Meetings of Councils, and the discussions which ensued seem to me to point to the conclusion that the worthy councillors, from the provosts downwards, have the most hazy ideas of the meaning or intentions of the "Food, Drink and Drugs Act," which they some years ago adopted—I presume *unanimously*. The newspaper reports of two of these meetings which I herewith send you, will prove entertaining. "The provost suggested that it was more for private individuals than the Town Council to send samples, and thought the clerk should write to me to the effect that the public were quite satisfied with the article supplied to them." Happy public! but of course "Where ignorance is bliss," &c. There is a certain grim humour in the worthy provost's remarks when taken in connection with the fact that a number of milks sent to me by a neighbouring burgh, were found in the majority of cases to be pretty freely watered. A member of the council "thought the inspector might be allowed to act without instructions," but a no doubt intelligent bailie said "the only time the officer could act was *when he got a case*." Perhaps the most amusing oration, however, was given by another councillor, who "thought the Analyst should employ some one here to take samples for him. They had been paying for this gentlemen for a considerable time, and *had never got a single article from him*. It was a consideration whether things should continue in this way or not." Verily here is indeed a second Daniel come to judgment. Seriously speaking, however, is it not a pity that any burgh authority should display so little understanding of the meaning of the "Act" or the duties of the Analyst? It seems to be but another instance of the popular idea that the Public Analyst is a species of roaring lion going about seeking whom he may devour, instead of a comparatively inoffensive individual who only does what he is asked, and is by no means too well remunerated for doing that.

I am, &c.,

A COUNTY ANALYST.

WATER ANALYSIS.

To the Editor of "The Analyst."

Sir,—As Medical Officer for a large combined urban and rural sanitary district, I have had to analyse a great number of waters during the past eight years. Hence I have had ample opportunity of becoming thoroughly acquainted with the character of the waters from the various localities in my district. Knowing thus their normal constitution and the local circumstances attending each case, I have unusual facilities for judging of the purity or otherwise of the samples submitted to me, and have therefore the advantage over any chemist who may have to form an opinion from arbitrary standards alone. I recently had occasion to analyse a certain well water from Newark-on-Trent several times, the results of my last analysis being given in the subjoined table—No. I. The analysis affording what I considered ample and conclusive evidence of sewage pollution, I reported to the sanitary authority that the water was unfit for drinking, and advised that the well should be closed.

On the refusal of the owners to comply with their request, the authority applied to the magistrates for an order to close it, under sec. 70, Public Health Act, 1875.

At an adjourned hearing of the case, a written report on the water by Dr. Charles Graham, of University College, was handed in by the defendants (see table No. II), in which he stated that the water was pure for dietetic purposes. On account of this conflict of opinion, the magistrates dismissed the summons.

Being convinced that my analysis and the conclusions I had drawn from it were correct, I forwarded a sample to Mr. Hehner, without giving him any information of the attending circumstances, and he reported that it was highly polluted, and unfit for drinking.

The sanitary authority thereupon applied again for a summons. Meanwhile, before the hearing of the fresh case, I personally delivered samples of the water to Dr. Dupré, and to Mr. Hehner, and again analysed a sample myself. They both condemned it as being polluted with sewage, and unfit for drinking (see tables Nos. III. and IV.).

When the case came on, Dr. Dupré was detained in London, but Mr. Hehner and I gave evidence, Dr. Graham's report being again handed in.

The magistrates were still not satisfied, so ordered a sample to be sent to an "independent analyst," selected by themselves.

Then appeared in a local paper, a letter to the defendants from Dr. Graham, in which he says "From the small amount of free and albuminoid ammonia, the small quantity of nitric acid, the absence of charring or blackening or ignition of the solids, the slight quantity of oxygen needed to burn the organic matter, even when kept at 100° F. for three hours, I am of opinion that the water is free from sewage infiltration. . . . . . . I am still of opinion that there are no grounds, from chemical data, to warrant anyone in condemning the water. . . . . . . Chemical examination does not justify the statement that the water has been polluted by sewage. It is indeed very free from organic impurities."

The magistrates sent the water to Dr. Frankland, and he subsequently reported that it consisted chiefly of the soakage from drains or cesspools, and was a very dangerous water, and quite unfit for dietetic use, also strongly urging the immediate closing of the well.

The magistrates then ordered that the well should be closed within a month.

Disagreements may be expected, no matter what method of analysis be employed, in the case of waters neither decidedly pure nor plainly bad; but in extreme cases of impurity, differences of opinion do not appear to be justifiable in the present state of chemical knowledge. Nothing lowers the profession of chemists in the eyes of the unscientific public so much as unaccountable and unseemly differences, when brought to light in a court of law.

Seeing that the concensus of opinion expressed by the other chemists consulted is so marked, may I venture to ask the learned Professor to reconsider the decision he has given with reference to the water in question.

I append the analytical data, and extracts from the reports alluded to above.

The results are expressed in parts per 100,000—grains per gallon, as given in two of the reports having been calculated up to this quantity.

	Chlorine.	SO_3.	Nitric Acid. N_2O_5.	Organic Carbon.	Organic Nitrogen.	Free Ammonia.	Albuminoid Ammonia.	Oxygen absorbed from Permanganate.	Phosphoric Acid.	Total Solids.
I. Ashby	7·60	—	15·72	—	—	·0005	·0196	·224	heavy traces	106·0
II. Graham	7·33	—	slight trace	—	—	·0020	·0154	·170	—	108·0
III. Hehner	7·48	17·8	16·15	—	—	·0004	·0195	·227	strong trace	106·4
IV. Dupre	7·80	—	16·90	—	—	·0020	·0360	·151	very much	104·8
V. Frankland	8·20	—	14·55	·951	·213	·0	—	—	—	103·0

The following are extracts from the reports :—

I. Ashby. The water is polluted with nitrogenous and carbonaceous organic matters. The large quantities of Cl., N_2O_5 and P_2O_5 found in it indicate that the impurities are of sewage origin. It is very impure and dangerous to health, and is quite unfit for dietetic purposes.

II. Graham. The amount of organic matter as indicated by the O used is low. The saline and albuminoid ammonia are equally satisfactory. The water is pure for dietetic purposes. It contains too much solid matter to be a high class water, but in other respects is satisfactory.

III. Hehner. It is very highly polluted with sewage. It is not only absolutely unfit for drinking and other domestic purposes, but its use would be fraught with considerable danger to the consumers. I would urgently advise the closing of the well.

IV. Dupre. It is very largely polluted by sewage or surface drainage, as shown by the very high proportion of N_2O_5, Cl., and P_2O_5 found, the excessive amount of albuminoid ammonia yielded, the rather large amount of O absorbed, and other points. The water is utterly unfit for drinking.

V. Frankland. It consists chiefly of soakage from drains or cesspools, and contains a very large proportion of organic matter of animal origin. It is a very dangerous water, and quite unfit for dietetic use. The well from which it was drawn should be closed without delay.

The question being one of extreme importance to all professional chemists and medical officers of health, must be my apology for the length of this communication, to which, together with any discussion that may arise from it, I hope you will, on the same count, kindly consent to give a place in your valuable paper.

I am, yours obediently,

Grantham, *May 20th, 1881.* ALFRED ASHBY.

LAW REPORTS.

Whisky Adulteration :—

Mr. Thomas George Mumford, proprietor of the "Union" Tavern, Mint Street, Borough, was summoned before Mr. Slade by Mr. Edwards, the officer appointed by the Vestry of Saint George, Southwark, for selling to the prejudice of the purchaser an article of food, viz., whisky, which was not of the nature, substance, and quality demanded by such purchaser, it being reduced spirits more than 25 degrees under proof. Mr. Slade observed that publicans were allowed to reduce spirits to the extent of 25 degrees, but 37 seemed rather too much. He asked Mr. Edwards if it was adulterated with anything worse than water. Mr. Edwards replied in the negative. The certificate stated "Not injurious to health." The defendant said, in answer to the charge, that he had only recently taken the business, and he was not aware that the whisky had been reduced to that extent. He was only in a small way of business. Mr. Slade fined him 10s., and 12s. 6d. costs.

Refusing to Serve, and Assault :—

At Hammersmith, on Saturday, Allen Mannering, of Crofton Terrace, Hammersmith, appeared to answer two summonses, one for refusing to sell a pound of butter to Henry Oatley, an inspector appointed under the Sale of Food Act, and the other for assaulting him in the execution of his duty. Mr. Jones, clerk to the Fulham District Board of Works, handed to the magistrate a certificate of the analyst, stating that the butter contained 80 per cent. of foreign fat other than butter. After hearing the evidence, which showed that the defendant was not the owner of the shop, Mr. Paget dismissed the summons for refusing to sell the butter, as he thought the purchase was complete. He, however, fined the defendant £5 for the assault.

Mr. J. H. Cornall, M.R.C.S., has been appointed Public Analyst for the Borough of Warrington.

RECENT CHEMICAL PATENTS.

The following specifications have been recently published, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

No. 1880	Name of Patentee.	Title of Patent.	Price.
3641	L. A. Groth	Decomposition of Salts of Ammonia	6d.
3644	J. C. Bloomfield	Manufacture of Cement	2d.
3731	B. Biggs	Separation of Acetic Acid from Crude Pyroligneous Acid and Spirit	2d.
3745	P. M. Justice	Purifying and Whitening Oils and Fats	4d.
3765	E. G. Brewer	Electric Lamps	1/2
3861	N. G. Richardson	Manufacture of Paper	2d.
3867	B. Hofmann	Manufacture of Oleine and Butterine	4d.
3939	E. H. T. Liveing	Colouring Alcohol for Thermometers	2d.
3971	A. M. Clark	Dynamo-Electric Machines	10d.
4017 & 4158	Ditto	Saving Hydrogen Gas Generated in Cleaning Wire	6d.
4056	W. Thompson	Manufacture of White Lead	8d.
4069	J. W. M. Miller	Preserving Animal and Vegetable Substances	2d.
4094	W. Elmore	Extracting Copper and other Metals from their Ores	4d.
4192	G. P. Harding	Electric Lamps for Engines	4d.
4303	T. Morgan	Converting Nitrogenous Organic Substances	4d.
5337	E. D. Brunel	Fire Extincteurs	6d.

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; Journal of Applied Science; The Boston Journal of Chemistry; The Provisioner; The Practitioner; New Remedies; Proceedings of the American Chemical Society; Le Practicien; The Inventors' Record; New York Public Health; The Scientific American; Society of Arts Journal; Sanitary Engineer of New York; The Cowkeeper and Dairyman's Journal; The Chemists' Journal; Oil and Drug News; The Textile Record of America; Sugar Cane; Country Brewers' Gazette; Smithsonian Report, 1879.

THE ANALYST.

JULY, 1881.

SOCIETY OF PUBLIC ANALYSTS.

An Ordinary Meeting of this Society was held on the 1st June, at Burlington House, the President, Mr. Heisch, in the chair.

The minutes of the previous meeting were read and confirmed.

Mr. Bernard Dyer and Mr. Hobbs were appointed scrutineers, and having opened the voting papers, they reported that the following had been elected as members:—E. G. Love, Ph.D., Analytical Chemist, New York; H. Leffmann, M.D., Analytical Chemist, Philadelphia.

Mr. C. M. Blades was proposed as a member, and will be ballotted for at the Country Meeting.

Mr. Wigner read a paper on "The Valuation of the Relative Impurities in Potable Water," and a long discussion ensued.

A Special Meeting of the Society was held at Burlington House on the 27th June. A Report of the Papers then read will appear in our next Number.

ON THE VALUATION OF THE RELATIVE IMPURITIES IN POTABLE WATERS.

By G. W. Wigner, F.C.S., F.I.C.

Read before the Society of Public Analysts, on 1*st June*, 1880.

About three years ago I submitted to the Society a scheme for the systematic valuation of the *impurities* found in potable waters, based upon the plan of giving a value to every constituent found in a water. This scheme was discussed at the time, and some suggestions then made were adopted and have rendered it more generally applicable. During three years the scheme has been tried by many analysts, and it is in consequence possible to discuss it with greater advantage.

Some six months ago the Water Committee of the Society very carefully considered the scale, and after a slight alteration of two or three items, it was decided to give it a temporary trial on the analyses of public water supplies made by the members of the Society for publication in The Analyst, and to bring the subject forward for discussion at this meeting.

In considering the details, one result of the alterations from the original scale must be borne in mind. Certain values have been altered, and consequently the value of 35 which I proposed as the limit of a first-class water may be no longer tenable, and I shall

therefore submit another proposal for that limit. It appears probable that we may find some further alterations are necessary in order to make it universally applicable to the various classes of waters from which public supplies are drawn.

I will at once assume that all analysts are agreed on the desirability of greater uniformity in the expression of opinion on the results of water analyses, as well as in the mode in which the analyses should be carried out.

In almost every case the purpose for which a water analysis is made is to obtain an opinion as to purity and suitability for domestic use, but at present it is a not uncommon occurrence that two analysts obtain results which are almost identical, and yet they differ considerably in the opinion they give on those results. It is with a view to obviate this undesirable state of things that we are to discuss the matter to-night.

There are certain points which will be very generally assented to, and may be used as starting points for the purpose of testing the proposed scale.

First. Every constituent found in the course of an ordinary water analysis must have a certain value or importance corresponding to the proportion in which it is found, no matter how small that proportion may be. It is quite true that when certain constituents, say, for instance, chlorine in chlorides or nitrogen in nitrates are present in very small proportions only, their importance may be so slight that they are ordinarily ignored in forming an opinion, but it is a more sound and logical course to consider their importance or value, small as it may be, as forming part of a total rather than to consider the determinations as valueless.

Second. If any constituent of a water, no matter what, is found in undue or excessive proportion, it ought to be sufficient to condemn that water for domestic use.

Third. There must be a certain minimum valuation approximating to that of the purest public supplies which should be passed as representing the constituents naturally occurring in the best waters. At first sight, it might appear wiser to allow a certain proportion of each constituent individually, say for instance 1 grain of chlorine or ·1 grain of nitrogen in nitrates, before the valuation; but in practice it is more convenient, and on the whole more satisfactory, to assume that if the valuation of all the constituents is less than say 15, the water is classed as of exceptional purity; and, similarly, it may be desirable to make a deduction corresponding to this figure in fixing the arbitrary limits between waters of different classes.

Fourth. Having deducted or allowed for the amount of mineral and organic constituents found in the best waters, we shall get a residual figure which will represent what may be called extraneous impurity, and this will really be the measure of the excess value of all the constituents determined, over what is present in the purest water supplies. It is practically certain that this difference, which is in fact the valuation of the extraneous impurities, will show clearly and reliably the variations which take place from week to week and month to month in the character of any one supply. But it is only by looking carefully at the details of the valuation scale that it is possible to see whether it will act with equal efficiency and certainty on supplies drawn from different sources, and on water stored or filtered in different ways.

It has been suggested that it will be necessary in some cases to make a lo[illegible] allowance or deduction, because of the difficulty of procuring a satisfactory water supply

certain parts of the country. The suggestion is unquestionably an important one; but it appears to me that it is preferable to report that the water of a certain district is less pure or more pure; leaving the fact of this difference of purity to be studied in a way which has not hitherto been practicable, because direct comparison of the characters of the waters has been extremely difficult.

The scale, as provisionally adopted by the Water Committee, had distinct reference to the scheme of water analysis formulated by them, and omits all reference to values to be given to organic carbon and nitrogen, and to the detailed mineral analysis, nor is any reference made to any value for the presence of heavy metals. It is obvious that some such allowance as the last is necessary, and when organic carbon and nitrogen are determined, definite values should be given to them in substitution for the values belonging to the albuminoid ammonia. The scale, as far as the purely chemical results are concerned, is as follows:—

Chlorine—·50 grn. per gallon	equal	1
Phosphoric Acid—Traces	,,	2
,, Heavy Traces	,,	4
,, Very heavy Traces	,,	8
Nitrogen in Nitrates —·10 grn. per gallon	,,	1
Ammonia, free ... —·005 ,, ...	,,	1
,, Albuminoid—·001 ,, ...	,,	1
Oxygen absorbed in 2 minutes—·002	,,	1
,, ,, 4 hours —·010	,,	1
Hardness before and after boiling (added together)—5°	,,	1
Total solid matter—5 grs. per gallon	,,	1

If any single value exceeds 10 the excess over ten is to be doubled and included in the addition. The values for the physical determinations will be found at the end of this paper.

Thus far the scale is convenient and of such a character that no analyst can have any difficulty in applying it to the results of any analysis, but as regards its application to the physical tests, viz., appearance, smell, and microscopical examination, its application is attended with more difficulty, and, as a natural consequence, more uncertainty.

While, therefore, I will consider the scale to-night in the first instance as published by the Water Committee, I shall suggest some alterations as regards these physical characters in order to render it feasible for different analysts working on their own results to obtain the same figures of valuation.

I wish to put the scale itself to a crucial test by applying it to three or four series of water analyses, and for this purpose I have had a sheet of tabulated analyses printed, the results of the physical tests being applied as accurately as is practicable.

The first series of waters to which I propose to call attention are 21 taken on the course of the Surrey Bourne, which is generally an underground river, but which has been flowing above ground during the last few months. The samples are arranged in consecutive order according to the flow of the river, commencing at the top of the watershed and following the course of the river through the whole of the valley, either on the surface or below ground, as the case may be; by taking samples from every well which is in the direct line of the

flow, and by sampling the flowing river itself at several intermediate points. All the samples were drawn on the same day, commencing at the top or source of the river and following the flow of the water downwards—(Table I.)

It is obvious on the first glance at the analyses that the water is fairly pure chalk water, and applying the valuation scale to it we find that out of the 21 samples, 7 show a valuation of 27, 3 of 28, and 2 of 29, or 12 samples agree within reasonable limits, and so give what we may consider as a standard of purity for judging of the bulk of the water, and enable local or accidental contamination to be more readily discovered and valued.

We have now to deal with 9 samples which show a greater valuation than 29, and we can consider these more contaminated samples with a special advantage which does not apply to the other analyses I shall submit to you, because I have been over the whole of the course with Mr. Baldwin Latham, who has for many years studied this remarkable subterranean waterflow, and we have visited each place from which samples have been obtained, and traced out as far as practicable any possible pollution which may have occurred.

No. 1. At the commencement of the Bourne the water might be expected to be of a high standard of purity, but it is not so, and on examination we find that at the place where the sample was taken, a large number of men and animals were at work, and that the excreta and dirt to some extent were passing into the outflow and contaminating the water. Four columns of this analysis show increased values, and the differences, although small in each constituent, so small in fact as to pass almost unnoticed, yet give a valuation of 8 more than the next sample.

At No. 5 there is again an increased value, and here it is found that drainage water from cultivated and presumably manured ground is contributing to the flow. On looking at the figures of the analysis, the only changes which attract attention are the increases in the chlorine which has nearly doubled, and in the nitrogen in nitrates; the results of the microscopical examination are somewhat less satisfactory, but yet taking all the figures and giving each the increased weight which it claims, seven columns give higher figures and the valuation increases to 42.

As the Bourne flows down the valley purification to some extent takes place, but at No. 8 we come to a sudden and remarkable increase in the valuation, which rises to 47. The cause is easy to find. The well from which the sample was drawn is in close proximity to a cesspool, and consequently, although no one figure of the analysis is altered very greatly except the chlorine, seven of the constituents show an increased valuation. No single figure shows increase enough to condemn the water, but the collective figures show that the value rises from 27 to 47, and if the water is not a second class one it is so near the margin as to be viewed with suspicion.

The flowing Bourne soon seems to get rid of this contamination, and I need not refer to one slight change at No. 12, further than to say that the proximity of a farm tells on the valuation, but pass on to No. 14, where the valuation suddenly rises from 27 to 46. Chlorine is lower than in the case of the last sample we considered; the nitrates have increased very greatly; ammonia and albuminoid ammonia show very little change; but there is an increase in oxygen absorbed, and perhaps a slightly worse result from the *microscopical examination*. Taking all the figures, however, eight different columns of the

valuation rise to tell the tale of another adjacent cesspool, and the water is at once marked as relatively polluted, although the analysis does not show any single excessively high figure.

Now these results, all obtained on the same general water flow, and for all practical purposes on the same water, with the sources of contamination thus accurately sought out, show that the broad principle of the valuation is correct, and even the figures of the scale itself are not likely to be far wrong when a cesspool or some manured fields in the neighbourhood of a flow averaging some six million gallons a day is thus distinctly indicated.

We can, with advantage, make another study from these analyses. In 13 of them, Nos. 2, 3, 6, 9, 10, 11, 13, 16, 17, 18, 19, 20, 21, we have values ranging between 27 and 30, one only reaching the latter figure. These samples being all approximately of the same quality and the same class of water, may be fairly averaged so as to arrive at the measure of condemnation afforded to each constituent.

The average value attached to the microscopical examination is 7·1 or one-fourth of the total. The microscope showed vegetable debris, animalculæ, mycelium and spores, with in one case fragments of straw and hair. These microscopical results of course are not satisfactory, and on the whole, the relative condemnation afforded by a valuation of 7·1 for them seems just.

The hardness and total solids together give an average valuation of 7·5 or rather more than one-fourth of the total. Considering that this water is on the whole a pure one, but very hard, it does not appear that this valuation of solid matters and hardness is too high.

The nitrogen in nitrates gives an average valuation of 3·7 corresponding to ·37 grains present. This proportion is of course considerably above the average of that found in public supplies; in fact, taking the March waters as reported in THE ANALYST, we only find four cases out of those 40 or 50 public supplies where such a large proportion was found. Therefore, although nitric acid is of less importance in a chalk water than in a shallow well water, it does not seem that the valuation assumed gives any undue relative importance to it.

The valuation for ammonia, free and saline, has been greatly increased since I originally laid the scale before the Society, but, judging from this series of analyses, it does not seem to be too high. Thus we find that the valuation of the ammonia in the whole of these 13 waters averages only ·5, and taking our May table of analyses there are only two waters which give a value exceeding 1, viz., King's Lynn 1·1, and Oldham 3·0.

Oxygen absorbed in two minutes and in four hours added together, shows an average valuation of only 1·0 on these waters; but from some other analyses, which I shall refer to later on, it will be seen that in the case of some peaty waters the condemnation value of oxygen absorbed becomes rather high, and I shall propose a modification which I think will be necessary.

We next have (Table II.) a series of hard chalk waters, two of which, viz., the supply of Canterbury in two different months, have been softened by the Clark process. In these analyses the microscopical results are almost uniformly satisfactory, and the table may be taken as very fairly representing the character of deep chalk wells through the greater part of the country.

A comparison of the analyses of the samples from Cambridge and from Canterbury will give a fair estimate of the improvement which, according to this valuation, is obtained

by the treatment of a water by the Clark process. The two waters before treatment are very similar in character, whereas after treatment the valuation is lowered from 23 to 14 or 15, this result being effected by decrease in the nitrogen in nitrates, ammonia, albuminoid ammonia, oxygen absorbed, hardness, and total solids.

The first eleven waters of this series are all samples supplied by the Kent Company, or drawn from their different wells. Only two of these call for special attention, one because the valuation is low and one because it is high.

The sample from the Shortlands wells gives a valuation of only 19, and on comparing this with the next sample it will be seen that the difference of 4 in the value is accounted for by decreases in the figures in seven different columns.

The sample of Kent water supplied for February shows a higher valuation, viz., 37, and this appears to be due to increases in nine different columns of the analysis, as compared with the January analysis of the same supply, the most important change, however, being produced by large increases in the proportions of nitrogen in nitrates and albuminoid ammonia.

I now propose to make some comparisons in a different way, by considering the supplies of the companies drawing their water partly or entirely from the river Thames, illustrated by the analyses made by our members in January, March and May of this year. I include the New River in this series, because part of that water is taken from the Thames.

It appears to me, that with the generally satisfactory character of the London tables of mortality, the general state of health of the population, and last, but by no means least, the great neglect of proper sanitary precautions in the house cisterns of the metropolis, we are bound to say that London water as supplied by these different companies, must, under ordinary circumstances, be considered of first-class quality. These waters (Table III) should give us an idea of a definite limit or standard by which to define a first class water. They would give us a valuation of about 40 as that at which the limit between first and second class water should probably be drawn, and allowing for the alterations in the scale this would correspond closely with the original limit of 35 which I suggested. Two samples only out of the 18 contained in the table, show a valuation exceeding 40; while 9, or 50 per cent. show valuations between 20 and 30. In February four of the London waters exceeded this limit, and in April every sample was below it.

This table may be considered in a different way from the Surrey Bourne series. All these waters have received certain and tolerably accurately known amounts of pollution, and have afterwards been subjected to oxidation, which is probably as complete as that received by most river waters. Unless, therefore, an exception is made for the Lambeth Company, which is pumping a considerable portion of its supply from the gravel, and this portion is probably different in character to the river water, these analyses must be considered and explained without the addition of any extraneous information.

The average valuation of these six companies' water during the last five months have been, Southwark and Vauxhall, 35; West Middlesex, 29; Grand Junction, 31; Lambeth, 39; Chelsea, 31; New River, 28; or taking those only included in Table III., Southwark and Vauxhall, 31; West Middlesex, 30; Grand Junction, 32; Lambeth, 41; Chelsea, 30; and New River, 29. On the average results, therefore, we have no exceptional figures *except possibly in* the case of the Lambeth water.

TABLE
Surf
Wat

Averaging the values given by each separate constituent we get the following: Appearance has an average valuation of 2. As a reason for this, in every case except one, we have a yellow or yellow green tint. In the other case there is a greenish brown tint. The smell has been reported as sensible in only one case, and therefore the average is too small to notice.

The chlorine has a value of 2·1, and varies very slightly in the different samples from a maximum of 2·5 to a minimum of 1·7. With one exception, phosphoric acid is returned as traces, and therefore takes an average value of 2.

Free and saline ammonia varies from ·0028, which occurred once in the New River water, to none in the Chelsea water, and the average valuation amounts to only ·2. Albuminoid ammonia varies from ·0092 in the Lambeth water to ·0010 in the New River, and gives an average valuation of 5.

Oxygen absorbed in two minutes varies from ·0010 in the Chelsea water to none in the West Middlesex, and gives an average valuation of 2. Oxygen absorbed in four hours varies from ·1250 in the Lambeth to ·0310 in the New River, and gives an average valuation of 1·4.

The hardness, which may be taken as 15° before boiling and 4° to 5° after, gives an average valuation of 3·8. The total solids value at 4·2, and the microscopical examination at 1·5.

These 18 analyses give us, therefore, another fair basis on which to estimate the equivalence of the different parts of the scale, and they confirm the impression that the oxygen absorbed in two minutes is over valued, and the free ammonia rather under valued. There appears some reason to think, as regards the oxygen absorbed, that the increased temperature at which the determinations are now being made has told more on the figures than was expected.

It is noteworthy that in these samples the microscopical examination has not shown any serious results, but has on the whole given satisfactory indication of the character of the water.

This table may be considered in another way by selecting the worst waters and comparing their figures. Thus it will be seen that the Southwark and Vauxhall water for March shows an increased valuation over January in the proportion of 39 to 28. This is accounted for by increases in the ammonia, albuminoid ammonia, oxygen absorbed in two minutes and four hours, hardness and microscopical results, or six different determinations.

The West Middlesex for January gives a valuation of 39, and for March of only 29, which is accounted for by changes in the chlorine, nitrates, ammonia, albuminoid ammonia, oxygen absorbed in two minutes, hardness, total solids, and microscopical results, or eight determinations.

The Grand Junction shows a valuation of 39 for March, and 28 for January, a difference accounted for by increases in the chlorine, nitrates, albuminoid ammonia, oxygen absorbed in two minutes and four hours, and hardness, or six determinations in all.

The Lambeth water for March has a valuation of 46, and for May of 28. The difference is accounted for by changes in the chlorine, albuminoid ammonia (which shows a very large difference) oxygen absorbed in two minutes and in four hours (which also shows a very large difference) hardness and total solids, or six different determinations.

The Chelsea supply gives a valuation of 33 for March and 22 for May, and this difference is accounted for by increases in the chlorine, nitrates, albuminoid ammonia, oxygen absorbed in two minutes and four hours, hardness and total solids, or seven determinations.

The New River for March shows a valuation of 31, and for May of 24, and this is made up by differences in the chlorine, nitrates, ammonia, albuminoid ammonia, oxygen absorbed in four hours, and hardness, or six determinations in all.

Therefore, in no case out of these 18 analyses is this increased condemnation dependent on less than the results of half-a-dozen determinations. It is consequently clear that this increased value represents an increase of extraneous impurity.

We will next consider 18 samples from sandstone, &c., which are included in the monthly returns for January, March and May (Table IV). These figures enable us to note another new feature in the valuation scale. The supplies of Whitehaven and Derby rank according to the scale among the purest of any that have been reported upon in the monthly analyses. The valuation of Whitehaven is 9 for March and May, and of Derby 12 for each month. Looking at the figures in the Whitehaven water in detail, we find that only two determinations in each of the analyses give a valuation exceeding one, viz., the microscopical examination, which in both cases show vegetable debris and diatoms, the albuminoid ammonia for March which gives a valuation of 2·1, and the oxygen absorbed in four hours for May, which values at 1·2.

Taking now the Derby water, we have four columns of the analyses, viz , the appearance, smell, oxygen absorbed in two minutes, and microscopical examination, which give simply negative results. The highest figures in the valuation are contributed by the hardness, which gives 3·8 and 3·0, and the total solids which show 3·6 and 3·5. The nitrates for March have a valuation of 2·2, and the chlorine for the two months 1·6 and 1·8 respectively.

From these analyses I obtain a limit for what may be called unavoidable impurity. It is indeed roughly, the degree of contamination of the most pure public supplies, and 15 seems a fair figure to take for this. Assuming, therefore, that 40 is adopted as the limit of first class water, and 15 as that of water of *exceptional purity*, it will be probable that 65 is a fair limit for a second class water, since it will allow for twice as much *extraneous contamination*.

From these exceptionally pure water supplies, I will pass to those slightly more contaminated, taking Manchester first. At a glance it is evident that the general supply of this town is good, and if the valuation figures are a clear indication, as I contend they are, it is uniform in character. I attach great importance to this uniformity. We find that January, March and May show valuations of 21, 23 and 21 respectively, while the intermediate months not included in the table give values of 22. It is evident that no deductions can be drawn from the variations in the character of this water, but for comparison we will see how it differs from the Whitehaven supply, because although the Manchester water is of good quality, it shows a valuation rather more than twice as high as Whitehaven.

The Manchester water was in two cases turbid, and in the third had a yellowish tint in addition to the green; this increases the valuation. In one case there was a peaty smell which also adds a fraction. The chlorine gives an average of ·76 as against ·37 in the Whitehaven water, or nearly twice as much, and shows an increased value of ·7. Phosphoric

acid was present in one case, but absent in both Whitehaven samples. Nitrates shows a very small decrease of ·1 which is more than counter-balanced by the increase in ammonia, which amounts to ·5. Albuminoid ammonia shows an increase of 2·4; oxygen absorbed in two minutes an increase of 4·5, and in four hours of 5·9, and total solid matter an increase of ·5, the microscopical examination showing a decrease. Thus we have nine columns in which the results are somewhat less satisfactory, and only two in which there is any indication of improvement. This gives a fairly conclusive indication that the increased valuation—though it certainly cannot be called condemnation—is fairly earned by the water.

Assuming 40 to be the limit for first class waters, the water supply of Leeds ranges very close to that number. We find the appearance and smell, phosphoric acid, and nitrates are practically the same as Manchester. The chlorine shows a small diminution of ·2; ammonia a decrease of 4, and albuminoid ammonia of 1; while the oxygen absorbed in two minutes gives an increase of 3·5; and that absorbed in four hours an increase of 11; the hardness of nearly 1, and the microscopical results of 5.

Now, in this case it is clear that the apparent increase of impurity is due almost entirely to the presence of vegetable matters, which, without doubt, are of a peaty character. If a peaty water is to be passed as satisfactory for a public supply, the condemnation afforded by the values given to the oxygen absorbed, and to the microscopical results is somewhat too great, but the water is certainly less pure than the Whitehaven and Manchester supplies; and what is of paramount importance, and is so pointed out by the value, is the fact that the water is not properly oxygenated.

Going one step further, we take the Bradford water. This also is peaty in character, and as regards its proportion of albuminoid ammonia does not differ to any noteworthy extent from the Leeds supply, but the total valuation runs up considerably. The change is due partly to a change in the colour, partly, though to a small extent, to an increase in the albuminoid ammonia, but very greatly to an increase in the amounts of oxygen absorbed in two minutes and four hours, the former of which shows an increased valuation of about 12 and the latter of 25. The hardness and total solids exercise very little influence on the total value. The condemnation here is marked and due almost entirely to the large amount of oxygen absorbed, *i.e.*, to defective æration. Therefore, this water might probably be much improved by mechanical agitation, such as a waterfall, or by the diminution of the growth which possibly exists in the large reservoirs.

Taking, therefore, these 18 waters all drawn from collecting grounds *supposed* to be free from any direct contamination with excreta, and only containing different proportions of peaty and other vegetable matter, the scale is found to be a practical and satisfactory one, and, if it errs at all, it is to make the condemnation of an impure water rather more emphatic, while it brings out in the clearest possible way the purity of such supplies as those of Whitehaven and Derby.

But even these three series of analyses are not sufficient in my opinion to fully confirm the value of the scale, and we will consider next some waters taken at random as they have come in for ordinary analysis, four of them being supplies of large towns not included in our monthly reports (Table V). These are purposely selected as being on the whole of less satisfactory character, and in order to show the way in which the scale works they are arranged in the order of their values. This renders it easy to view them again from another

point of view, and we will take first the our waters—A, B, C, D—which each show a value of less than 50.

A is from a deep well in a district not very largely populated, and shows only one determination (the hardness), which has a valuation exceeding 5. No figure of the valuation indicates heavy organic contamination, and the water passes well within first class.

B is from a shallow well. The proportion of oxygen absorbed shows a higher figure, the other figures of the analyses being fairly identical, except total solids.

Passing over the next three analyses as being of little moment except for comparison, I come to G, H, and J, which give values of 82, 89, and 89. They may fairly be looked at together. The chlorine in each is high, and gives values of 16·4, 16·9, and 16·4 respectively. The valuation for phosphoric acid in one case is eight. The nitrates in J, which is a shallow well in the sandstone, rise to 30, a figure which in itself, without the other details of the analyses being considered, is almost condemnatory.

In G the free ammonia values at 22, the albuminoid ammonia in that sample values at 13·8, and in the next at 13·6. The highest value reached by the oxygen absorbed is 10·4 in J, and the highest value for total solids is 17 in H, which contains 67·3 grains of total solid matter per gallon. The microscopical results acquire no undue weight, as the highest value is 6.

Looking at the three samples as a whole, 20 out of the 36 valuations exceed 5, and eight of them exceed 10. It will be found as a general rule that any single valuation which exceeds 5 is undesirable, and that any valuation which exceeds 10 casts grave suspicion upon a water, and these three analyses bear out that statement very closely.

Again, passing over one or two intermediate analyses, we will consider M, N, O, which are all waters from chalk wells comparatively near to the sea-shore, but in one case at least (O) inspection on the spot proved that surface drainage from cultivated land and from an adjacent farmyard enter to a considerable extent. In the other two samples, drainage water from arable land has been proved to find its way into the leaky water tubes. The valuations of these three waters are respectively 198, 218, and 300, and, therefore, if the valuation scale is of any good at all, these waters are unfit to drink. They differ in character very considerably, and afford another and very fair standpoint from which to judge the scale. The appearance in each case gives a value of 6. In M the chlorine has a value of 130, in O of 30, and in N of 154. If salt is objectionable in a drinking water, we have it here in such quantity that two of the waters are condemned by the proportions of chloride of sodium, independently of any other constituent in the analyses. These proportions, which are 42 grains per gallon in N, and 35 grains in M, are, of course, quite sufficient to render the water, when warmed, distinctly saline and insipid to the taste.

Phosphoric acid is valued at from 4 to 2 in the three samples, and nitrates range as high as 6. Free ammonia in M gets a value of 2·6, while in O the albuminoid ammonia shows ·0763, and has a value of 143, which is probably quite sufficient in the opinion of every analyst who has ever used the albuminoid ammonia process to condemn the water, whether a valuation scale be used or not.

The oxygen absorbed in four hours in O, the least saline water of the three, has a value of 80·6, tallying to some extent in its degree of condemnation with that due to the albuminoid ammonia. The total solids of course show a high value.

Now these waters, although emphatically condemned, are so condemned on a less number of different items than is the case in some other instances. In N and M only six columns in each case get a higher value than 5, and in O only eight columns get a higher value than that, but against this must be set the fact that we have in each sample one valuation exceeding 130. The condemnation is severe, but surely not unjust for such a figure as this.

One more series of waters I must take for the purpose of comparison, and these are the May waters analysed by the members of the Society, the analyses of which appeared in the June number of THE ANALYST. It is unnecessary to go at detail through these, especially as some have already been referred to, but it is worth while to consider some three or four of the most pure and three or four of the most impure ones.

The Bath water for May shows a valuation of 11, and only two of the determinations reach 4, viz., the hardness and total solids. The scale clearly applies well to that water.

The Hull water values at 14, only one figure, the total solids, reaching 4. There is no trace of organic impurity, and that water evidently is justly passed as of first class quality.

Llandrindod again gives a total valuation of 10, and only one determination, the hardness, exceeds 3 in value.

We will now consider three cases where the valuations exceed 50, viz., Greenock, with a valuation of 94; King's Lynn, of 106; and Dudley, of 55. Bradford has already been dealt with.

Taking Dudley first, the condemnation is based mainly upon the excessive amount of oxygen absorbed in four hours, viz., ·1834, valuing at 29. If the figures stood alone, we might be almost inclined to doubt the desirability of condemning water upon it, but the same determination for March gave 1, which is quite sufficient to show that the water is non-aerated, and this result coupled with the other figures is sufficient to take the water out of the possible pale of first class.

At Greenock again the condemnation is due more to the proportion of oxygen absorbed than to any other figure, the amount absorbed in four hours reaching ·2550, valuing at 41. We have no previous analysis of this water for comparison, and therefore must deal with it on its merits. It is evident that the water is lamentably non-oxygenated, and despite its softness and tolerably moderate amount of nitrogenous compounds, except as albuminoid ammonia, it does not seem at all too strong to say that the water is unfit to be used as the public supply of any town.

The King's Lynn water is valued at 106, and the condemnation is made upon the albuminoid ammonia, with a valuation of 14, and the oxygen absorbed in two minutes and 4 hours with a valuation of 15 and 46 respectively, and every other constituent in the analysis, except the free ammonia, gets a value of from 3 to 4. The water is therefore what may be best described as bad all round. The colour, smell, phosphoric acid, nitrates, albuminoid ammonia, and the microscopical results are all unsatisfactory. Looking at this, therefore, 106 is not at all too high a condemnatory value for the water which must be described as a bad third class one and unfit to be supplied to any town for drinking water.

I think I have now tested the scale as it exists, and is in use in the most exhaustive manner practicable within the time at our disposal, and it only remains for me to see what alterations are practicable or desirable. The main change necessary certainly seems to be in the valuation given to the oxygen absorbed.

When I first proposed the scale three years ago it was not contemplated to maintain the water at a temperature of 80°, while the permanganate solution was acting, or to increase the duration of the test. This increase of temperature increases the relative power of the permanganate, and I think the result of the comparison of all the figures shows that, if the valuation for the two minutes determination is allowed in future for the absorption which takes place in 15 minutes instead of 2, a more just opinion on the character of a water will be arrived at.

The free ammonia valuation may need increase so as to allow 1 for every ·002 grain per gallon, but I prefer at present to leave this unaltered till longer experience shows if it is needed or not.

These are the only two alterations which I think really desirable in the chemical part of the scale, but one other point has to be considered. The microscopical examination takes, as at present arranged, a maximum valuation of 10. This value is not high enough to be given to that determination by an analyst in the daily habit of using the microscope, and that and some of the other physical determinations should have an increased value. I, therefore, propose the following amplified scale, as regards the physical tests coupled with the slight amendment of the chemical valuations, which consists in giving the same value to oxygen absorbed in 15 minutes as has been previously taken by that absorbed in 2 minutes.

I give the figures in the order in which they appear in our monthly reports. It is, of course, obvious that the microscopical valuation is merely an outline, the details of which must be subsequently filled up.

Appearance in 2-ft. tube.		
C. blue		0
C. pale yellow		2
C. green		2
C. dark yellow		4
C. dark green		4
Suspended matter to be added to valuation of appearance.		
For traces		1
,, heavy traces		2
,, turbidity		4
Smell when heated to 100° F.		
Vegetable matter		1
Strong peaty		2
Offensive, of animal matter		4
Chlorine in Chlorides	50 grs. per gal.	= 1
Phosphoric acid as phosphates.		
Traces	= 2 h. traces = 4 v. h. traces	= 8
Nitrogen in Nitrates	·100 gr. per gal.	= 1
Ammonia	·005 gr. ,,	= 1
Albuminoid Ammonia	·001 gr. ,,	= 1
Oxygen absorbed in 15 minutes at 80° Fah.	·002 gr. ,,	= 1
,, ,, 4 hours ,, ,,	·010 gr. ,,	= 1
Hardness before and after boiling added together	5°	= 1
Total Solid Matter	5 grs. per gal.	= 1
Heavy Metals	S. traces	= 6
,, ,,	H. ,,	= 12

Microscopical results.

Vegetable debris in small quantity	4
,, ,, large ,, ...	8
Diatoms and Bacteria in small quantity	6
,, ,, large ,, ...	12
Hairs, and animal debris ...... 10 to 20, according to the quantity observed.	

Mr. Wigner concluded by moving "That a water valuation scale analagous to that which has been suggested be recommended by the Society for the adoption of its members."

Dr. Muter said that, to place the matter fairly before the Society, he thought it very desirable that they should first of all debate the general question, viz.: Were or were they not to have a valuation scale for water analyses. He himself believed thoroughly in the fundamental principles of such a scale as that so ably put before them that evening by Mr. Wigner, but there might be gentlemen present who did not share that belief, and they would have an opportunity on the present motion of bringing forward their views, and should they be, as he hoped, rejected by the meeting, then it would be desirable to discuss the items of the scale *seriatim*. He therefore, without further occupying time at that stage of the proceedings, begged to second Mr. Wigner's motion.

Mr. Lyte said no one could fail to be struck with the great meed of truth that there was in Mr. Wigner's scale, and the members would, he thought, be inclined to agree that a scale be adopted on that basis.

Mr. Thomas moved as an amendment "That it is premature to adopt any fixed water valuation scale at present and that it be not considered." He said that one of the reasons why he opposed the adoption of the scale was that a peaty water (Bradford water in Table IV.), which he considered a good water, was valued at 65; whereas if one knew the previous history of a water and that was unfavourable, he would have no hesitation in condemning it, although its valuation was below 65. He for one would never pledge himself to use the scale. It was not for the Society to *adopt* anything, and it was entirely out of harmony with the constitution of the Society.

Mr. Hehner seconded the amendment and said they must first know the history of the waters with which they had to deal, and then apply the scale. If they did not know the history the scale was absolutely useless. Water containing a good deal of chlorine would be rejected and yet it might not be a bad water at all. Chloride of sodium did not do any harm if it were not derived from pollution. He thought it was impossible to adopt a scale unless the analyst knew what water he had under his hand, and if he did know there was no need to adopt any scale.

Dr. Dupré said he should be sorry to meet the proposal with a direct negative because he was fully convinced that Mr. Wigner had gone into the matter very carefully, and that the valuation scale really on the whole followed very closely what would be the general opinion on a given water. At first sight there appeared to be discrepancies, for instance, the value attached to albuminoid ammonia seemed far too low in any given water. On closer examination it would, however, be found that where the albuminoid ammonia was high that was never the only thing which was high; it was always accompanied by certain other constituents that increased the value, and therefore the value of the albuminoid ammonia was really that of the albuminoid ammonia plus the other constituents that increased

simultaneously, and therefore he believed the scale had on the whole been remarkably well adjusted. At the same time he was not prepared for the Society to adopt it yet, and should be inclined to propose that the scale be provisionally used in the monthly table published in THE ANALYST so that they could see it in print.

Mr. Dyer said that in many cases the scale might be valuable, and especially for private use, but he certainly should not like to see the Society pledged to the adoption of any scale.

On the amendment being put it was rejected.

Dr. Dupré then moved as an amendment "That such a scale be provisionally used and that the figures be published with the published water analyses of the Society until the end of this year," and said he was quite of opinion that it was premature to definitely adopt a scale at present, but he had faith enough in the scale to think that it ought to get a fair trial, and it would never get a fair trial unless a number of analyses were published with the values attached. For himself, he had gone into the scale now and then, and was convinced there was something in it. He had before expressed his opinion that the scale should be improved by raising the valuation of a particular constituent if accompanied by something else—if for example, albuminoid ammonia were accompanied by a certain proportion of nitric acid, to increase the valuation attached to albuminoid ammonia. The same with chlorine: for a certain amount of nitric acid together with chlorine, increase the ordinary value attached to nitric acid, so that a polluted water would probably come out higher than in the present case.

In the case of ammonia, Mr. Wigner had proposed that it should be doubled. He had just had four waters from deep wells, some over 500 feet deep, remarkably pure waters as regards albuminoid ammonia and oxygen absorbed, in fact, all but perfect in these respects, but three of them contained something like ·08 parts of ammonia, which would alone give a valuation of 70 on the altered scale. In other words, it would bring what was a really first class water down to a third class one. He thought that showed that the valuation of any particular constituent should be to some extent governed by the rest of the constituents. In waters as perfect as these were, the valuation of ammonia should be very low. If on the other hand, they had a water which showed that it was really a polluted water, the value put on ammonia should be high.

The next difficulty was the oxygen absorbed. That also he thought ought to be governed by something beside itself. It was perfectly clear that a water contaminated by animal matter which absorbed a given amount of oxygen should have a very much higher value attached to the oxygen than a peaty water. A peaty water might not be a pleasant water to drink or look at, but no one had a right to say that it was a dangerous water. If by means of the oxygen absorbed they condemned such a water, they laid themselves open to severe and very just criticism. The oxygen therefore should be governed by something else. No nitric acid being present the oxygen must be valued low, but with nitrates present it must be valued high.

Dr. Tripe, in seconding the amendment, remarked upon the figure 10 being fixed as the maximum valuation of the whole of the microscopical results, including bacteria, infusoria, cotton and other fibres, muscular tissue and epethelial debris, and said that if he understood aright a peaty water might have a valuation of 80 attached to it because of the

quantity of oxygen absorbed, and 10 only put for the whole of these evidences of direct sewage contamination. He therefore objected to that number and considered it ought to be enlarged by so much being given to epithelium, muscular fibre, vibrions, and so on. Microscopists could not at present invariably distinguish between some forms of innocent bacteria and those which would cause disease, and yet a valuation of 10 only was given to bacteria which might spread typhoid, summer diarrhœa, or some other form of disease. And therefore bacteria and other things showing direct sewage contamination should be valued higher.

Dr. Dupré deprecated putting a prohibitory value to any particular constituent, and doubted very much whether a water was ever found with bad microscopical results where all the other results were not bad too.

Dr. Muter said that were the original motion, which he still urged on their consideration, carried, he should have moved the omission at present of any valuation being given to physical characters, such as colour, odour and microscopic appearances, because those must always be a matter of opinion, and he thought that only definite chemical points for which they could get figures should be at present considered. At the same time he was not to be taken as detracting from the importance of these indications in experienced hands. The point from which they ought not, however, to wander was—is there to be a scale or not, and he hoped that they would not part without coming to a definite decision on this broad principle, favourable to the adoption of a scale. He did not think that it was desirable to ask The Analyst to take a responsibility, which the Society as a whole dreaded to assume, and this being the tendency of Dr. Dupré's amendment he could not accept it, but still pressed the original motion of Mr. Wigner on the notice of the meeting.

Mr. Heisch said that as far as he understood Dr. Dupré he did not wish the consideration of the subject postponed indefinitely, but to have the results of the valuation scale as applied to the waters analysed by the members of the Society published with the analyses every month. He thought that if this were done, and analysts would give anything like a definite account of the microscopic examination, they would at the end of six months be better able to judge of the scale than at present. He had a very great belief in the value of microscopic examinations, not only of the deposit from water but also of the residue of the evaporation of a drop on a slide and was always much guided by these in his estimate of a water, but at present was not prepared to give a definite value to each individual object found.

After some other remarks Dr. Dupré's amendment was put and lost.

The discussion having extended to an unusually late hour,

Dr. Tripe then proposed, and Mr. Allen seconded, another amendment, "That the further consideration of the matter be adjourned till the first available meeting in January next."

This was carried, and the discussion was adjourned accordingly.

Instructions for Water Analysis.—On page 131 we print a further part of these Instructions.

PUBLIC WATER SUPPLIES OF ENGLAND.

VALUATION OF THE ANALYSES PUBLISHED IN THE ANALYST ACCORDING TO THE SCALE REFERRED TO IN MR. WIGNER'S PAPER.

SUPPLIES.	January.	February.	March.	April.	May.	June.
Kent Co.	22	42	28	30	32	23
New River	23	36	31	26	24	18
East London	45	37	26	23	28	36
Southwark and Vauxhall	27	42	39	32	36	30
West Middlesex	34	43	25	23	21	31
Grand Junction	26	32	41	28	28	25
Lambeth	47	48	46	27	26	29
Chelsea	34	36	31	34	22	26
Bath	..	..	..	14	11	11
Birmingham	30	34	32	32	35	33
Bradford	40	65	51	47	57	58
Brighton	..	20	27	22	26	26
Bristol	..	29	22	27	22	19
Cambridge	31	25	26	23	32	29
Canterbury	15	18	18	19	16	15
Croydon	32	37	28	19	20	28
Derby	36	20	15	13	12	14
Droitwich	..	42	33	..	42	..
Dudley	..	33	47	..	55	..
Edinburgh	..	25	30	40	21	25
Exeter	17	28	16	20	17	18
Grantham	25	..	29	26	25	30
Huddersfield	17	25	35	23	21	20
Hull	21	27	23	26	20	20
King's Lynn	60	76	89	103	106	131
Leamington	28	30	..	..	..	21
Leeds	37	45	30	26	40	34
Leicester	..	63	61	27	27	30

SUPPLIES.	January.	February.	March.	April.	May.	June.
Liverpool	..	37	41	36	31	34
Llandrindod	..	18	11	..	10	..
Maidstone Water Company	..	..	49	34	30	42
,, Public Conduit	..	..	43	32	30	40
Manchester	21	26	23	22	21	19
Newark	..	60	..	26	32	..
Newcastle-on-Tyne	37	40	39	34	33	38
Norwich	36	37	40	23	48	32
Nottingham	..	..	26	50	47	32
Oldham	34	..	..	20	15	..
Plymouth	..	38	31	18	..	..
Portsmouth	..	37	36	29	20	27
Reading	..	37	23	25	20	20
Rochdale	..	..	..	9	10	8
Rugby	..	..	30	35	42	58
Salford	12	12	21	27	18	21
Sheffield	22	25	20	20	20	..
Shrewsbury	22	37	24	20	20	18
Southampton	..	34	50	39	41	50
Stockport	..	..	14	20	18	..
Stourbridge	..	38	30	..	44	..
Stourport	..	32	23	..	26	..
Sunderland	25	28	24	23	24	..
Swansea	..	16	12	17	21	12
Warwick	35	..	31	..	37	..
Whitehaven	..	13	10	4	7	11
Wolverhampton	..	65	49	37	35	42
Worcester	..	64	61	48	47	..

THE ANALYSIS OF THE PUBLIC WATER SUPPLIES OF ENGLAND.*

INSTRUCTIONS FOR WATER ANALYSIS.

Prepared by a Committee appointed by the Society of Public Analysts.

WHEN the Society of Public Analysts arranged to publish monthly analyses made by its members of the water supplies of the leading towns in the kingdom, they contemplated the possibility of bringing about more general agreement than had formerly been practicable in the processes used, and the modes of reporting results. The scheme proposed has met with marked acceptance among analysts who, no doubt, in many cases may have reason to prefer other methods, but who have given way in favour of a system which appears to concern the general good of the profession, and to be for the public advantage.

This concord of opinion has already rendered it necessary to print a second edition of the instructions for water analysis, which were issued to the analysts engaged; and a third, but more detailed edition, is now called for. To answer the requirements of those who have been in correspondence with the Secretaries on the subject, this third edition contains such full and explicit details as will enable any competent analyst to execute a water analysis in such a way as to make the results *directly comparable* with those obtained by any other analyst working under these instructions.

The instructions do not take the form of an elementary treatise on water analysis, but they specify the essential details of the manipulation in such a way as to be intelligible to a skilled analyst.

The Water Committee of the Society has not been free from difficulty in the duty which it has undertaken, as it was only possible to adopt processes the details of which were such as could be carried out with ease and uniformity by the great body of analysts. On this account some matter in itself valuable has necessarily been omitted, such as the estimation of organic carbon and nitrogen, the instructions for more complete microscopical examinations, and Messrs. Crookes, Odling and Tidy's method for taking the colour of water.

The Committee has freely availed itself of published works and papers on water analysis, and has, as far as possible, tested every reported process, whether contained in the well-known treatises on the subject, or in the various papers contributed to their own and other Societies.

The method of reporting the results in grains per gallon has been adopted after very careful and mature consideration. The Committee are well aware that if reports were made in parts per 100,000, they would be equally intelligible to analysts generally, but they cannot overlook the fact that these reports have in many cases to pass into the hands of those to whom a statement in parts per 100,000 is more or less unintelligible. The instructions are worded in such a way that analysts can use either the English or the metric system of weights and measures for their own work, and can prepare their standard solutions according to either system, simply making their reports uniform by the adoption of the English figures. The tables of aliquot parts of a gallon, and factors, which are included in the instructions, will facilitate the necessary calculations.

* It having been decided to publish the new edition of the Instructions for Water Analysis in THE ANALYST, we have arranged to page the monthly divisions so that the whole will bind up together when completed.

THE PREPARATION OF REAGENTS.

NOTE.—*All solids are to be weighed and liquids measured.*

A.—REAGENTS FOR THE ESTIMATION OF CHLORINE.

(*a*) *Standard Solution of Silver Nitrate*—

Dissolve 4·7887 parts of pure recrystallised silver nitrate in distilled water, and make the solution up to 1000 parts. The solution is to be standardized against the standard solution of sodium chloride, and adjusted if necessary: 1 c.c. = ·001 gramme of chlorine, or 10 grains = ·01 grain chlorine.

(*b*) *Standard Solution of Sodium Chloride*—

Dissolve 1·648 parts of pure dry sodium chloride in distilled water, and make the solution up to 1000 parts. 1 c.c. solution contains ·001 chlorine, or 10 grains contain ·01 grain chlorine. The pure sodium chloride is best prepared by taking a saturated solution of best commercial sodium chloride, filtering it cold, and passing a current of HCl. gas into it. The gas produces a fine crystalline precipitate of pure sodium chloride, which must be washed rapidly with cold water and dried at about 500° to 600° F.

(*c*) *Potassium Monochromate*—

50 parts of potassium monochromate are dissolved in 1000 parts of distilled water. A solution of silver nitrate is added until a permanent red precipitate is produced, which is allowed to settle.

B.—REAGENT FOR THE ESTIMATION OF PHOSPHORIC ACID.

Molybdic Solution—

One part pure molybdic acid is dissolved in 4 parts ammonia, sp. gr. ·960. This solution, after filtration, is poured with constant stirring into 15 parts of nitric acid of 1·20 sp. gr. It should be kept in the dark and carefully decanted from any precipitate which may form.

C. REAGENTS FOR THE ESTIMATION OF NITROGEN IN NITRATES.

(*a*) *Solution of Silver Sulphate*—

A saturated solution of silver sulphate in distilled water.

(*b*) *Concentrated Sulphuric Acid*—

In order to ensure freedom from oxides of nitrogen, this should be kept in a bottle containing mercury, and agitated from time to time, which will ensure their absence.

(*c*) *Metallic Aluminium*—

As thin foil.

(*d*) *Solution of Sodium Hydrate*—

Dissolve 100 parts of solid sodium hydrate in 1000 parts of distilled water. When cold, introduce a strip of about 100 square cms., say 15 square inches, of aluminium foil previously heated to just short of redness, wrapped round a glass rod. When the aluminium is dissolved, boil the solution briskly in a porcelain basin until about one-third of its volume has been evaporated, allow it to cool, and make it up to its original volume with water free from ammonia. The solution must be tested by a blank experiment to prove the absence of nitrates.

(*e*) *Broken Pumice*—

Clean pumice broken into pieces of the size of small peas, sifted free from dust, heated to redness, and kept in a closely stoppered bottle.

(f) Hydrochloric Acid free from Ammonia—

If the ordinary pure acid is not free from ammonia, it should be distilled. As only two or three drops are used in each experiment, it will be sufficient if that quantity does not contain an appreciable proportion of ammonia.

(g) Copper Sulphate Solution—

Dissolve 30 parts of pure copper sulphate in 1000 parts of distilled water.

(h) Metallic Zinc—

As thin foil. This should be kept in a dry atmosphere, so as to be preserved as far as possible from oxidation.

(i) Standard Solution of Ammonium Chloride—(see D *a).*

(k) Nessler's Solution—(see D *b).*

D.—Reagents for the Estimation of Nitrogen as Ammonia and Albuminoid Ammonia.

(a) Standard Solution of Ammonium Chloride.

Dissolve 3·146 parts of pure ammonium chloride in 1000 parts of distilled water free from ammonia. For use, dilute this with pure distilled water to ten times its bulk.

(b) Nessler Solution.

Dissolve 35 parts of potassium iodide in 100 parts of water. Dissolve 17 parts of mercuric chloride in 300 parts of water. The liquids may be heated to aid solution, but if so must be cooled. Add the latter solution to the former until a permanent precipitate is produced. Then dilute with a 20 per cent. solution of sodium hydrate to 1000 parts; add mercuric chloride solution until a permanent precipitate again forms; allow to stand till settled, and decant off the clear solution. The bulk should be kept in an accurately stoppered bottle, and a quantity transferred from time to time to a small bottle for use. The solution improves by keeping.

(c) Sodium Carbonate.

A 20 per cent. solution of recently ignited pure sodium carbonate.

(d) Potassium Permanganate Solution.

Dissolve 200 parts of potassium hydrate and 8 parts of pure potassium permanganate in 1100 parts of distilled water, and boil the solution rapidly till concentrated to 1000 parts.

(e) Distilled Water which is free from Ammonia.

Distilled water which gives no reaction with Nessler test is pure enough. But, if this is not available, take the purest distilled water procurable, add pure ignited sodium carbonate in the proportion of one part per 1000, and boil briskly until at least one-fourth has been evaporated.

E. Reagents for the Estimation of Oxygen Absorbed.

(a) Standard Solution of Potassium Permanganate—

Dissolve ·395 parts of pure potassium permanganate in 1000 of water. Each c.c. contains ·0001 gramme available oxygen, and each one grain contains ·0001 grain.

(b) Potassium Iodide Solution—

One part of the pure salt re-crystallized from alcohol, dissolved in 10 parts distilled water.

(c) Dilute Sulphuric Acid—

One part by volume of pure sulphuric acid is mixed with three parts by volume of

distilled water, and solution of potassium permanganate dropped in until the whole retains a *very faint* pink tint, after warming to 80° F. for four hours.

(d) Sodium Hyposulphite—

One part of crystallized sodium hyposulphite dissolved in 1000 parts of water.

(e) Starch Water—

One part of starch to be intimately mixed with 500 parts of cold water, and the whole briskly boiled for five minutes, and filtered, or allowed to settle.

F. Reagents for the Estimation of Hardness.

(a) Standard Solution of Calcium Chloride—

Dissolve eight grains of pure crystallized calc spar in dilute hydrochloric acid in a platinum dish, adding the acid gradually, and taking precautions to prevent loss by spurting. When all is dissolved, evaporate to dryness in a water-bath, add a little distilled water and again evaporate to dryness. Repeat several times to ensure the expulsion of all the acid. Lastly, dissolve in water and make up to one-tenth of a gallon. For use: dilute to 10 times its volume, the result will be water of 8° of hardness. Or, instead of making the solution thus, dissolve 1·376 grains pure crystallized selenite in $\frac{1}{10}$th gall. water, and that will be the water of 8° of hardness.

(b) Standard Soap Solution—

Take 150 parts lead plaster (*Emplastrum Plumbi* P.B.), rub in a mortar with 40 parts dry potassium carbonate; when fairly mixed add absolute alcohol which has been standing over potassium carbonate for a few days. When solution is complete, filter and add sufficient recently boiled distilled water to reduce the alcohol to the strength of proof spirit. The solution of soap must then be reduced to the proper strength with proof spirit made by mixing recently boiled distilled water with the absolute alcohol prepared as directed above. It should be of such strength as just to form a permanent lather, when 180 grain measures are shaken with 1000 grains of a solution of lime of 8° hardness. The following table will then give the degrees of hardness corresponding to the number of grain measures employed:

Hardness.	Grain Measures.		Hardness.	Grain Measures.
0°	9	...	5°	120
1°	29	...	6°	140
2°	54	...	7°	160
3°	77	...	8°	180
4°	99	...		

After which 1 degree = 20 grain measures. This is the last solution recommended by Dr. Clarke, the one referred to in his patent not being quite accurate.

1. Collection of Samples.—All samples of water for analysis must be collected in stoppered glass bottles which have been cleaned by successive rinsings with acid and water. A Winchester quart will suffice. Stoneware bottles must not be used. Each bottle must be filled with the water to be sampled, and emptied, before the sample is taken for analysis. The bottle must then be filled to the neck, stoppered, and tied down.

Each report should specify the place where, and the date and time when, the sample was drawn. Wherever practicable, it is desirable to report the temperature of the water *at the time the sample was taken*, and also to observe whether the water when collected is clear or not. For an accurate analysis of a public water supply, it is essential that the sample should not be drawn from a cistern; a public stand-pipe, cab rank, or fire hydrant, is generally the most satisfactory place from which to take a sample; but, failing this, the ball-cock of a cistern is a permissible source. It is desirable to avoid drawing stagnant water from a pipe or dead main, and it is especially necessary to avoid ærating the water in *the act of filling the bottle.*

CORRESPONDENCE.

[The Editors are not responsible for the opinions of their Correspondents.]

THE WATER SUPPLY OF PHILADELPHIA, U.S.A.

To the Editor of "The Analyst."

Sir,—I send herewith a statement of a partial analysis of Schuylkill Water, the sample having been taken on May 17th, from the laboratory hydrant. I am satisfied that the character of the water has not changed in any important particular since last month.

SCHUYLKILL WATER.

Chlorine	0·53
Nitrogen as Nitrates and Nitrites	0·0500
Free Ammonia	0·0014
Albuminoid Ammonia	0·0028
Sediment	Vegetable debris with siliceous matter.

In the report published in May number, the decimal points have been in two cases wrongly printed: the numbers should be, nitrogen as nitrates 0·0500 instead of 0·500 as printed; and oxygen consumed should be 0·0560 instead of 0·560 as given.

HENRY LEFFMAN, M.D.

920, *Walnut Street, Philadelphia, May* 27*th*, 1881.

Errata.—In the concluding portion of Mr. Heisch's Paper on the "Swedish Acts affecting Sale of Poisons" on page 101, four lines from the bottom, ·04 inch should be ·08; and on the same page, line 6 from top, the sentence should read—"It is remarkable that all Coal Tar Colours, if they contain arsenic, or other poisonous matters are mentioned, but, &c."

Errata.—"Instructions for Water Analysis," Reagents, p. 129, D. (*a*), 1000 parts, should be 10,000 parts.

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; Journal of Applied Science; The Boston Journal of Chemistry; The Provisioner; The Practitioner; New Remedies; Proceedings of the American Chemical Society; Le Practicien; The Inventors' Record; New York Public Health; The Scientific American; Society of Arts Journal; Sanitary Engineer of New York; The Cowkeeper and Dairyman's Journal; The Chemists' Journal; Oil and Drug News; The Textile Record of America; Sugar Cane; Country Brewers' Gazette; The Medical Record; Report on Sorghum and Cornstalks, Washington; Department of Agriculture.

THE ANALYSES OF THE PUBLIC WATER SUPPLIES OF ENGLAND.

To ensure the completion of the analyses in time for the reports to be included in the monthly table, it has been thought desirable that these reports should in future comprise samples drawn between the 15th of one month and the 15th of the following month. Thus samples drawn between July 15th and August 15th should be considered as being the August supply. It will be very convenient if the analysts engaged will kindly forward their reports to the secretaries early in each month, and the arrangement now adopted will facilitate their doing so.

Analyses of English Public Water Supplies in June, 1881. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Date when drawn.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine in Chlorides.	Phosphoric Acid in Phosphates.	Nitrogen in Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in		Hardness, Clark's Scale, in degrees.		Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
									2 mins. at 80° Fahr.	4 hours at 80° Fahr.	Before Boiling.	After Boiling.			
Kent Co.	June 12	p. grn. yelw. clr.	none	1·17	traces	·228	none	·0034	none	none	16·5°	5·0°	23·00	little vegetable debris	Wigner & Harland.
New River	" 20	clear colourless	none	1·17	traces	·150	none	·0010	·0010	·0280	15·0°	4·8°	19·60	satisfactory	B. Dyer.
East London ..	" 10	c. green yellow	slight	1·21	traces	·154	·0011	·0067	none	·0734	15·0°	3·6°	19·60	mineral mttr. veg. debris	Wigner & Harland.
Southwark & Vauxhall ..	" 13	f. yellow & clear	none	1·12	trace	·130	none	·0067	·0022	·0605	14·5°	4·5°	19·88	satisfactory	J. Muter.
West Middlesex	" 10	faint yellow	none	1·01	trace	·139	·0010	·0080	none	·0570	13·6°	3·7°	19·01	no deposit	O. Hehner.
Grand Junction		v. pale yellow	none	1·10	traces	·196	·0002	·0045	·0019	·0414	13·1°	3·6°	19·40	no deposit	A. Wynter-Blyth.
Lambeth	" 13	f. yellow & clear	none	1·24	trace	·130	none	·0067	·0022	·0515	14·5°	4·5°	20·16	satisfactory	J. Muter.
Chelsea	" 15	c. greenish yelw.	none	1·00	trace	·140	none	·0042	·0030	·0500	13·5°	3·0°	17·92		A. Dupré.
Bath	June 20	c. f. blue	none	·90	none	·012	none	·0005	none	none	17·0°	5·0°	22·5	no deposit	J. W. Gatehouse.
Birmingham ..	" 7	s. turbid green.	none	1·19	traces	·185	·0020		·0056	·0189	9·73°	5·88°	18·17	vegetable matter	A. Hill.
Bradford	" 15	s. yelw. transpt.	none	·65	none	none	·0010	·0063	·0260	·1500	3·7°	3·5°	6·80	no deposit	F. M. Rimmington.
Brighton	" 8	p. yellow blue	slight	1·91	traces	·245	·0018	·0017	none	·0072	12·7°	8·5°	23·80	vegetable debris	Wigner & Harland.
Bristol	" 13	pale green	none	1·13	trace	·054	·0007	·0035	·0014	·0070	15·0°	1·2°	25·80	sand, vegetable debris	F. W. Stoddart.
Cambridge	" 8	c. pale blue	none	1·34	traces	·461	none	·0028	·0081	·0257	16·0°	4·0°	23·80	satisfactory	J. West-Knights.
Canterbury	" 16	pale blue	none	1·47	none	·338	·0005	·0005	·0040	·0110	6·3°	5·7°	11·76	very slight mineral	S. Harvey.
Croydon	" 10	bright colourless	none	1·19	trace	·379	none	·0040	none	·0420	15·5°	9·0°	23·2	vegetable fibre and sand	C. Heisch.
Darlington	" 4	c. green	none	·68	trace	·025	trace	·0056	·0070	·1345	6·9°	4·5°	11·20	satisfactory	W. F. K. Stock.
Derby	" 13	v. good	none	·95	trace	·115	·0007	none	trace	·0094	10·9°	4·9°	17·99	satisfactory	L. Archbutt.
Edinburgh	" 17	c. colourless	none	0·83	none	trace	·0032	·0056	·0080	·0704	5·45°	4·20°	6·88	no sediment	J. Falconer King.
Exeter	" 11	f. greenish yelw.	none	·84	trace	·193	·0035	·0014		·0490	2·8°	2·8°	6·30		F. P. Perkins.
Glasgow (Port)	" 3	v. f. yellow	none	·79	trace		·0011	·0056	·0150	·1000	2·5°	2·5°	6·30	satisfactory	John W. Biggart.
Grantham	" 16	c. greenish blue	none	1·05	trace	·696	·0022	·0028	none	·0272	13·6°	5·6°	21·67	few diatoms	A. Ashby.
Huddersfield ..	" 14	yellowish green	none	·50	none	·025	none	·0035	none	·0061	2·0°	2·0°	4·50	peaty matter	G. Jarmain.
Hull	" 20	good	none	1·32	traces	·240	·0030	·0019	·0030	·0040	15·3°	3·7°	23·00	satisfactory	J. Baynes, Jun.
Ipswich	" 18	v. f. yellow	none	2·31	trace	·560	·0042	·0036	none	·0102	23·7°	4·2°	34·00	satisfactory	J. Napier.
King's Lynn* ..	" 3	decidedly turbid	dedly. wdy.	1·66	h. traces	·2886	·0074	·0098	·0225	·2865	15·0°	4.3°	20·03		William Johnstone.
"	" 5	decidedly turbid	dedly. wdy.	1·38	h. traces	·6300	·0028	·0056	·0187	·3762	15·0°	4.2°	19·46		
"	" 6	decidedly turbid	dedly. wdy.	1·47	h. traces	·4200	·0028	·0084	·0200	·4375	15·1°	4.5°	19·74		
"	" 7	decidedly turbid	dedly. wdy.	1·68	h. traces	·3500	·0056	·00280	·0268	·4285	15·8°	4.8°	20·93		

SOCIETY OF PUBLIC ANALYSTS.

Analyses of English Public Water Supplies in June, 1881. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Date when drawn.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine in Chlorides.	Phosphoric Acid in Phosphates.	Nitrogen in Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in 2 mins. at 80° Fahr.	Oxygen, Absorbed in 4 hours at 80° Fahr.	Hardness, Clark's Scale, in degrees. Before Boiling.	Hardness, Clark's Scale, in degrees. After Boiling.	Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
Leamington ..	June 10	c. bright green.	none	1·40	none	none	·0014	·0028			23·6°	12·1°	28·70	none	A. Bostock Hill.
Leeds	„ 16	greenish yellow	none	·74	trace	none	none	·0039	·0112	·0868	3·4°	2·9°	4·76	none	T. Fairley.
Leicester......	„ 15	s. yellow	none	1·05	trace	·110	·0012	·0030	·0025	·0720	7·0°	4·70°	14·60	vegetable debris diatoms	W. L. Emmerson.
Liverpool	„ 15	greenish yellow	slight peaty	1·15	trace	·103	·0011	·0084	·0028	·0896	5·2°	5·1°	9·38	no deposit	A. Smetham.
Maidstone—															
Wtr. Company	„ 16	clear	none	2·90	trace	·115	none	·0031	·0098	·0112	16·6°	6·6°	35·17	none	M. A. Adams.
Public Conduit	„ 16	clear	none	2·60	trace	·115	none	·0013	·0098	·0089	17·3°	6·6°	34·30	none	M. A. Adams.
Manchester....	„ 17	c. colourless	none	·61	none	none	·0028	·0039	·0047	·0559	1·9°	1·9°	5·78	no deposit	W. Thomson.
Newcastle-on-Tyne......	„ 8	f. yellow	none	·88	trace	·046	·0010	.0090	·0060	·0960	12·9°	4·5°	16·00	satisfactory	J. Pattinson.
Norwich	„ 12	s. greenish yelw.	none	1·90	traces	·083	traces	·0060	·0340	·0830	13·1°	4·7°	21·60	satisfactory	W. G. Crook.
Nottingham ..	„ 13	c. bluish green	none	1·63	h. traces	·945	·0007	·0027	none	none	15·0°	8·5°	21·40	fibres veg. debris diatoms	Wigner & Harland.
Portsmouth ..	„ 14	clear	none	1·26	trace	·114	trace	·0026	none	none	14·0°	2·1°	16·10	veg. deb. decayed diams.	W. J. Sykes.
Reading	„ 14	very clear	none	·90	none	·880	·0005	·0042	·0035	·0280	14·8°	3·9°	19·40	satisfactory	J. Shea.
Rochdale	„ 15	pale blue	none	·58	none	·014	·0014	·0026	·0028	·0300	1·80°	1·60°	4·98	satisfactory	T. A. Collinge.
Rugby†	„ 2	turbid	none	1·26	h. traces	·008	·0010	·0105	·0137	·0687	16·6°	8·4°	28·00	veg. deb. anim. diatoms	A. P. Smith.
Salford	„ 17	cloudy yellow	none	·55	none	none	·0021	·0028	·0050	·0530	3·0°	2·5°	5·50	oxide of iron	J. Carter Bell.
Shrewsbury ..	„ 11	c. colourless	none	1·50	none	·250	·0010	·0020	none	none	19·0°	4·5°	25·00	none	T. P. Blunt.
Southampton..	„ 20	yellowish	none	1·05	h. traces	·539	·0025	·0086	·0080	·0800	12·5°	4·6°	19·60	vegetable debris	A. Angell.
Swansea	„ 17	clear	none	·90	trace	none	·0007	·0049	·0030	·0040	2·5°	2·5°	3·71	none	W. Morgan.
Whitehaven ..	„ 7	c. f. green	none	·37	traces	·015	none	·0011	none	·0116	·4°	·4°	1·83	mvg. orgms. veg. deb. &c.	A. Kitchin.
Wolverhampton	„ 13	yellowish tinge	none	1·33	h. traces	·051	·0003	·0098	·0027	·0826	12·6°	5·7°	20·30	very small chiefly diams.	E. W. T. Jones.

Abbreviations:—c., clear; f., faint; h., heavy; p., pale; v. h., very heavy; v. s., very slight.

* The samples drawn on 3rd and 5th represent the water after a continuance of very dry weather, and the other two samples were drawn after 12 and 36 hours continuous rain.

† This is filtered well water, and differs much in character from previous analyses, which were made on the surface water. In hot weather the surface supply fails, and the well is used.

LAW REPORTS.

Prosecution of a Medical Practitioner for selling Defective Chemical Food:—

On 19th April last, at Glasgow, Dr. James Downie was charged, before Sheriff Balfour, at the instance of the Local Authority, with a contravention of the Food and Drugs Act, by selling a bottle of chemical food which did not contain the requisite percentage of ingredients. The bottle was purchased on the forenoon of March 3rd last, at the drug shop at 4, Abercromby Street, by Mr. Robert Inglis, ordinary sanitary inspector, for purposes of analysis, and he paid 2s. for the bottle. It was supplied by a girl, who told Mr. Inglis that if he waited till six o'clock he might see Dr. Downie. On being analysed by the Public Analyst the drug was found to contain ·47 of a grain of phosphate of iron, and ·38 of a grain of phosphate of lime, whereas it should have contained 2½ grains of phosphate of iron and 1 grain of phosphate of lime. For the defence it was contended that Dr. Downie, who had been in partnership with a medical student, had had nothing to do with the shop for the past eighteen months, but only used a room off the shop for the purpose of consulting with patients, although the business was carried on in Dr. Downie's name, and with his consent. The Sheriff found the charge proven, and imposed a fine of £3.

Gin Adulteration:—

Frank Dore, landlord of the Greycoat Boy, Roan Street, Greenwich, and Thomas Sadler, of the Rose and Crown, Thames Street, were summoned by the Greenwich District Board of Works for selling gin which was adulterated to the prejudice of the purchaser. Mr. Cordon, inspector to the Board, proved purchasing the gin and submitting it to the Public Analyst, who certified that Dore's was 41·5 and Sadler's 42 degrees under proof, but the admixture was not injurious to health. In defence, Dore said he told his barmaid to add 25 gallons of liquor to the 100, and she took a measure which held half-a-pint over the gallon. He had discharged her for the error. In the case of Sadler, Mr. Ruddle, solicitor, sought to prove that the strength of the gin had evaporated through being kept in a small vat in a room where there was a high temperature. He called a witness, who is employed at Holland's distillery, who said that gin would evaporate to the extent of 5 per cent. at least under such circumstances. The shifting would also cause evaporation. Mr. Marsham said a publican ought to see that the gin was of proper strength when he sold it. The law made a very liberal allowance, which must not be exceeded. He fined Dore £2 and Sadler £2 10s.

RECENT CHEMICAL PATENTS.

The following specifications have been recently published, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

No. 1880	Name of Patentee.	Title of Patent.	Price.
3898	C. Dickinson	Treating Sewage, &c.	2d.
4014	H. A. Bonneville	Preserving Animal and Vegetable Substances	4d.
4136	C. Barker	Separation of Zinc from other Metals	10d.
4191	G. P. Harding	Electric Lamps	6d.
4259	A. Gutensohn	Utilizing Phosphate of Alumina to obtain Phosphoric Acid	2d.
4274	C. Kesseler	Impregnating, &c., Water by Liquid Carbonic Acid	6d.
4292	D. S. Dawe	Manufacture of Portland Cement	2d.
4334	S. H. Johnson	Production of Saccharine Substances	4d.
4428	J. H. Johnson	Electric Lamps	4d.
4433	B. J. Mills	Converting Refuse and Infectious Animal Matters into Gas	8d.
4468	W. Black and T. Larkin	Furnaces for Calcining Carbonate of Soda	6d.
4511	J. Mactear	Furnaces for Chemical Processes	10d.
4514	W. F. Nast	Manufacture of Sugar from Cellulose or Ligneous Materials	4d.
4520	J. S. Stevenson	Apparatus for Distilling Ammoniacal Liquor	2d.
4522	J. Imray	Economising Nitrous Products in Manufacture of Sulphuric Acid	4d.
4541	W. A. Barlow	Purification of Alcohol	6d.
4614	C. W. Siemens	Electric Lamps	6d.
4651	W. S. Somers	Manufacture of Soap	2d.
4655	J. Chapman and G. B. Bates	Manufacture of Paints	2d.
4742	J. Bowing	Manufacture of Caustic Compounds	2d.
4745	J. E. H. Gordon	Electric Lamps	2d.
4773	H. J. Haddan	Manufacture of Diphenylamine of Aniline	2d.

2. Appearance in 2-foot Tube.—The colour or tint of the water must be ascertained by examination in a tube 2 feet long and 2 inches in diameter. This tube should be made of glass as nearly colourless as may be, and should be covered at each end with a disc of perfectly colourless glass cemented on, an opening being left for filling and emptying the tube. This opening may be made either by cutting a small segment off the glass disc at one end or by cutting a small segmental section out of the tube itself before the disc is cemented on. These tubes are most conveniently kept on hooks in a horizontal position to prevent the entrance of dust.

The tube must be about half filled with the water to be examined, brought into a horizontal position level with the eye, and directed towards a well illuminated white surface. The comparison of tint has to be made between the lower half of the tube containing the water under examination, and the upper half containing atmospheric air only.

3. Smell.—Put not less than 3 or 4 ounces of the water into a clean 8-ounce wide-mouth stoppered glass bottle which has been previously rinsed with the same water. Insert the stopper and warm the water in a water-bath to 100° F. (38° C.). Remove the bottle from the water-bath, rinse it outside with good water perfectly free from odour, and shake it rapidly for a few seconds; remove the stopper, and immediately observe if the water has any smell. Insert the stopper again and repeat this test.

When the water has a *distinct* odour of any known or recognized polluting matter, such as peat or sewage, it should be so described; when this is not the case, the smell must be reported simply as none, very slight, slight, or marked as the case may be.

4. Chlorine.—This is to be calculated as chlorine, and returned under the heading of "Chlorine in Chlorides."

Titrate at least 100 c.c. or 1,400 grains of the water with the standard silver nitrate solution, either in a white porcelain basin or in a glass vessel standing on a porcelain slab, using potassium chromate as an indicator. The titration is conducted as follows: The sample of water is measured into the basin or beaker, and 1 c.c. or 15 grains of potassium chromate solution added. The standard silver nitrate solution is then run in cautiously from a burette until the red colour of the precipitated chromate of silver, which is always observed at the point where the silver solution drops in, is no longer entirely discharged on stirring. The burette is then read off. It is best to repeat the experiment, as follows: Add a few drops of dilute sodium chloride solution to the water last titrated, which will discharge the red colour. Measure out a fresh portion of the water to be titrated into another basin and repeat the titration, keeping the first sample, the colour of which has been discharged, side by side with the second, so as to observe the first permanent indication of *difference* of colour. If the quantity of chlorine be so small that still greater accuracy is necessary, the titration may be conducted in the same way as last described, but instead of the operator looking directly at the water containing the chromate solution, he may place between the basin containing the water and his eye a flat glass cell containing some water tinted with the potassium chromate solution to the same tint as the water which is being tested, or may look through a glass coated with a gelatine film coloured with the same salt. Care must always be taken that the water is as nearly neutral as possible before titration. If originally acid it should be neutralized with precipitated carbonate of lime. If the proportion of chlorine be less than ·5 grain per gallon, it is desirable to take a larger quantity of the water, say 250 c.c. or 3,500 grains,

for the estimation, and to concentrate this quantity on the water-bath before titrating it so as to bring it to about 100 c.c. or 1,400 grains. This titration may be performed by gaslight.

5. PHOSPHORIC ACID.—This is to be returned under the heading of "Phosphoric Acid in Phosphates." The ignited total residue, obtained as hereafter directed, is to be treated with a few drops of nitric acid and the silica rendered insoluble by evaporation to dryness. The residue is then taken up with a few drops of dilute nitric acid, some water is added, and the solution is filtered through a filter previously washed with dilute nitric acid. The filtrate, which should measure 3 c.c. (or say 50 grains), is mixed with 3 c.c. of molybdic solution, gently warmed, and set aside for 15 minutes at a temperature of 80° F. The result is reported as "traces," "heavy traces," or "very heavy traces," when a colour, turbidity, or definite precipitate are respectively produced, after standing for 15 minutes.

6. NITROGEN IN NITRATES.—This should be determined by one or other of the following processes, viz., *Crum*, *Copper-zinc or Aluminium*. Analysts should report which process is employed.

Crum Process.—This should be carried out in a Lunge's nitrometer as follows:—250 c.c. or $\frac{1}{16}$th gallon of the water must be evaporated to a small bulk, the chlorine precipitated with solution of silver sulphate, filtered and concentrated in a basin to 2 c.c. or 30 grs. measure. A Lunge's nitrometer is charged with mercury, and the 3 way stop-cock closed, both to measuring tube and waste pipe. The concentrated filtrate is poured into the cup at the top of the measuring tube, and the vessel which contained it rinsed with 1 c.c. of water, and the contents added. The stop-cock is opened to the measuring tube, and, by lowering the pressure tube, the liquid is sucked out of the cup into the tube. The basin is again rinsed with 5 c.c. of pure strong sulphuric acid, and this is also transferred to the cup and sucked into the measuring tube. The stop-cock is once more closed, and 12 c.c. more sulphuric acid put into the cup, and the stop-cock opened to the measuring tube until 10 c.c. of acid have passed in. The excess of acid is discharged, and the cup and waste pipe rinsed with water. Any gas which has collected in the measuring tube is expelled by opening the stop-cock and raising the pressure tube, taking care no liquid escapes. The stop-cock is closed, the measuring tube taken from its clamp and shaken by bringing it slowly to a nearly horizontal position and then suddenly raising it to a vertical one. This shaking is continued until no more gas is given off, the operation being, as a rule, quite complete in fifteen minutes. Now prepare a mixture of 1 part of water with 5 parts of sulphuric acid, and let it stand to cool. After an hour, pour enough of this mixture into the pressure tube to equal the length of the column of acidulated water in the working tube, bring the two tubes side and side, raise or lower the pressure tube until the mercury is at the same level in both tubes, and read off the volume of the nitric oxide. This volume expressed in c.c.'s and corrected to normal temperature and pressure gives, when multiplied by ·175, the nitrogen in nitrates, in *grains per gallon*, if 250 c.c. of the water have been used. According to some authorities the precipitation of the chlorides is not necessary.

Copper-Zinc Process.—This must be carried out as follows:—A wet copper-zinc couple is prepared by taking a piece of clean zinc foil, about 3 in. by 2 in., and immersing it in a solution of copper sulphate, containing about 3 per cent. of the pure crystallized salt. A copious and firmly adherent coating of black copper is speedily deposited upon the

surface of the zinc, which must be allowed to remain in the solution until the deposit is thick enough, but not for too long a time or it will become pulverulent and not adhere firmly to the zinc—three or four minutes will generally be sufficient.

The zinc coated with copper must then be removed from the solution, which may be bottled for subsequent use, and the couple thoroughly washed first with distilled water, and finally with the water to be analysed, in order that this may replace the adhering distilled water. It is then put into a clean 6 or 8-ounce wide-mouth stoppered glass bottle and covered with the water to be analysed, which may be 3 or 4 ounces or more in quantity. If the water be very soft a small addition, say one part per 1000, of sodium chloride, will accelerate the reaction. The stopper must then be inserted in the bottle and the water allowed to remain overnight in a warm place. If still greater speed be necessary the temperature may be raised to 90° or 100° F. (32° or 38° C.). With hard water it is preferable to add a small quantity of pure oxalic acid to precipitate the lime and quicken the reaction. On the following morning, the conversion of the nitrates into ammonia will be complete, and the proportion of ammonia formed must be estimated in one of the two following ways according to the character of the water.

If the water be sufficiently tinted to show a perceptible colour in the Nessler glass, or if it contains magnesium salts or other substances capable of being precipitated by the Nessler reagent, a measured portion of the sample after treatment with the copper-zinc couple must be distilled and the distillate nesslerized as hereafter described. If the water is not tinted, and does not contain any other substance that would interfere with the delicate action of the Nessler re-agent, it may be nesslerized direct. It will sometimes be necessary to dilute the water considerably before nesslerizing in order to enable the reading to be accurately taken. Ammonia found must be calculated to *nitrogen*, and not to ammonia, as in the nesslerizing of the ammonia distillates. The nitrogen, present as ammonia, must of course be deducted from the proportion found.

If any doubt exists as to the completion of the reaction, this may be ascertained by testing for nitrous acid, by adding a small quantity of a solution of metaphenylene diamine to a portion of the fluid acidified with sulphuric acid. A yellow colour will be produced in a few minutes if nitrous acid be present. If none be present the reaction is complete.

Aluminium Process.—This is carried out as follows :—50 c.c. or 1000 grains of the water are introduced into a retort, and 50 c.c. or 1000 grains of a 10 per cent. solution of caustic soda, free from nitrates added. If necessary, the contents of the retort should be distilled until the sample is free from ammonia. The retort is then cooled and a piece of aluminium foil introduced into it. The neck of the retort is inclined upwards and its mouth closed with a perforated cork, through which passes the narrow end of a small chloride of calcium tube filled with powdered pumice or glass beads wetted with very dilute hydrochloric acid free from ammonia. This tube is connected with a second tube containing pumice stone moistened with strong sulphuric acid, which serves to prevent any ammonia from the air entering the apparatus, which is allowed to stand in this way for a few hours or overnight. The contents of the first absorption tube—that next the retort—are washed into the retort with a little distilled water free from ammonia, and the retort adapted to a condenser. The contents of the retort are distilled to about half their original volume. The distillate is collected and an aliquot part nesslerized ; and, if necessary, the rest of the distillate is diluted, and an aliquot part again nesslerized as hereafter directed.

7. Ammonia Free and Albuminoid.—The estimation of ammonia present in the water in a free or saline form, and of that yielded by the nitrogenous matter present in the water (commonly called albuminoid ammonia), is to be made on the same portion of the sample to be analysed.

Take not less than 500 c.c. or 7000 grains (one deci-gallon) of the water for these determinations, and distil in a 40 oz. stoppered retort, as this is large enough to prevent the probability of portions of the water being spurted over into the condenser. The neck of the retort should be small enough to pass three or four inches into the internal glass tube of a Liebig's condenser. If the fit between the retort and the inside tube of the condenser is good, the joint may be made by wrapping a small piece of washed tinfoil round the retort tube so as to pass just inside the mouth of the condenser tube. Many analysts prefer, however, to work with a retort fitting loosely into the condenser; and in such cases the joint between the two may be made in one of the two following ways:—1st. either by an ordinary indiarubber ring—such as those used for the tops of umbrellas—which has been previously soaked in a dilute solution of soda or potash—being stretched over the retort tube in such a position that when the retort tube is inserted in the condenser it shall fit fairly tightly within the mouth of the tube about half an inch from the end; 2nd, preferably, when the shape of the large end of the condenser admits of it, by a short length, say not more than two inches, of large size indiarubber tubing, which has been previously soaked in a dilute solution of soda or potash, being stretched outside both retort tube and condenser tube, so as to couple them together, so that the tube of the retort still projects some inches into that of the condenser. It is very desirable to have a constant stream of water round the condenser whenever it can be obtained. Before distillation a portion of the water must be tested with cochineal in order to ascertain if it shows an alkaline reaction. The portion so tested must, of course, be rejected and not put into the retort. If the water does not show an alkaline reaction, a sufficient quantity of ignited sodium carbonate, to render the water distinctly alkaline, must be added. The distillation should then be commenced, and not less than 100 c.c., or, say, 1400 grains, distilled over. The receiver should fit closely, but not air-tight, on to the condenser. The distillation should be conducted as rapidly as is compatible with a certainty that no spurting takes place. After 100 c.c., or, say, 1400 grains, have been distilled over, the receiver should be changed, that containing the distillate being stoppered to preserve it from access of ammoniacal fumes. 100 c.c. measuring flasks make convenient receivers. The distillation must be continued until 50 c.c., or, say, 700 grains, more are distilled over; and this second portion of the distillate must be tested with Nessler's reagent to ascertain if it contains any ammonia. If it does not, the distillation for free ammonia may be discontinued, and this last distillate rejected; but, if it does contain any, the distillation must be continued still longer, until a portion of 50 c.c., or, say, 700 grains, when collected, shows no colouration with the Nessler test. The whole of the distillates must be nesslerized as follows:—The standard solution for comparison must be such that it contains ·317 parts per ten thousand of chloride of ammonium (= one part of ammonia in 100,000). The distillate is transferred to a clean Nessler glass, and one-twentieth of its volume of Nessler solution added. The Nessler solution must be clear and of a pale straw tint, when seen in an 8-oz. bottle. No turbidity must ensue on the addition of the Nessler solution to the water, as such turbidity would be a proof that the distillate was contaminated, and must, therefore, be rejected, and the determination repeated.

After thoroughly mixing the water and Nessler solution in the glass, an approximate estimate can be formed of the amount of ammonia present by the amount of colouration produced in the solution. It will now be necessary to mix one or more standard solutions with which to compare the tint thus obtained. These solutions must be made by mixing the standard solution of chloride of ammonium with distilled water absolutely free from ammonia, and subsequently adding some of the same Nessler solution as was previously added to the distillate. This precaution is essential, because the tint given by different samples of Nessler solution varies. A colorimeter may be used, if preferred, instead of Nessler glasses.

As soon as the distillation of the free ammonia has been started, the alkaline solution of permanganate of potash should be measured out into a flask ready for addition to the water under examination for the distillation of the albuminoid ammonia. The volume of the alkaline permanganate solution to be taken must be at least one-tenth of that of the water which is being distilled, and should not exceed that proportion unless the water is of very bad quality, and the solution must be made in accordance with the directions contained in these instructions. This solution must be diluted with four times its own volume of water, and must be placed in a flask and boiled during the whole time that the distillation of the sample for free ammonia is being carried on, care being taken that the concentration does not proceed to too great an extent. There must be enough of this boiled and diluted alkaline permanganate solution to make up the residue in the retort to about 500 c.c. or 7000 grains. When the distillation of the sample of water for free and saline ammonia is completed, the alkaline permanganate solution which has been thus diluted and boiled will be ready for use, and the distillation for albuminoid ammonia may be proceeded with as follows:—

To the residue left in the retort from which the free ammonia has been distilled, add the alkaline permanganate solution to make it up again to a volume of at least 500 c.c., or say 7000 grains, and the lamp being replaced, the distillation must be continued, and successive portions of the distillate again collected in precisely the same way as during the process of distillation for free ammonia.

After 200 c.c. or 3000 grains, say two-fifths of the volume contained in the retort have been distilled over, the receiver should be changed, and further portions of 50 c.c., or 700 grains, collected separately, until the distillate is practically free from ammonia. The distillates must then be mixed, and nesslerized in the same way as previously directed for free ammonia. The result so obtained must be calculated to ammonia in grains per gallon, and returned as albuminoid ammonia.

Special care must be taken that the atmosphere of the room in which these distillations are performed is kept free from ammoniacal vapours, and that the receivers fit close, but not airtight, to the end of the Liebig's condenser. It is also specially necessary to observe that the colour of the distillate deepens gradually after the addition of the Nessler re-agent, and that it is not possible to read off the amount of colour correctly until the nesslerized liquor has stood for at least three minutes, and been intimately mixed with the Nessler solution.

Special care must be taken that the retort, condensers, receivers, funnels, Nessler glasses, &c., used are all rendered perfectly free from ammonia before use. Where the water in use in the laboratory is good, this may be used to thoroughly rinse the apparatus two or three times, draining out the adhering water; otherwise pure distilled water must

be used. These ammonia and albuminoid ammonia determinations should be made as soon as possible after the water has been received for analysis.

8. Oxygen Absorbed.—Two separate determinations have to be made, viz., the amount of oxygen absorbed during 15 minutes, and that absorbed during four hours; both are to be made at a temperature of 80° F. It is most convenient to make these determinations in 12-oz. stoppered bottles, which have been rinsed with sulphuric acid and then with water. Put 250 c.c. or 3,500 grains into each bottle, which must be stoppered and immersed in a water-bath or suitable air-bath until the temperature rises to 80° F. Now add to each bottle 10 c.c. or 100 grains of the dilute sulphuric acid, and then 10 c.c. or 100 grains of the standard potassium permanganate solution. Fifteen minutes after the addition of the potassium permanganate, one of the bottles must be removed from the bath and two or three drops of the solution of potassium iodide added to remove the pink colour. After thorough admixture, run from a burette the standard solution of sodium hyposulphite, until the yellow colour is nearly destroyed, then add a few drops of starch water, and continue the addition of the hyposulphite until the blue colour is just discharged. If the titration has been properly conducted, the addition of one drop of potassium permanganate solution will restore the blue colour. At the end of four hours remove the other bottle, add potassium iodide, and titrate with sodium hyposulphite as just described. Should the pink colour of the water in the bottle diminish rapidly during the four hours, further measured quantities of the standard solution of potassium permanganate must be added from time to time so as to keep it markedly pink.

The hyposulphite solution must be standardized, not only at first, but (since it is liable to change) from time to time in the following way:—To 250 c.c. or 3500 grains of pure redistilled water add two or three drops of the solution of potassium iodide, and then 10 c.c. or 100 grains of the standardized solution of potassium permanganate. Titrate with the hyposulphite solution as above described. The quantity used will be the amount of hyposulphite solution corresponding to 10 c.c. or 100 grains as may be of the standardized potassium permanganate solution, and the factor so found must be used in calculating the results of the hyposulphite titrations to show the amount of the standard permanganate solution used, and thence the amount of oxygen absorbed.

The difference between the quantity of hyposulphite used in the blank experiment and that used in the titration of the samples of water multiplied by the amount of available oxygen contained in the permanganate added, and the product divided by the volume of hyposulphite corresponding to the latter is equal to the amount of oxygen absorbed by the water.

9. Hardness Before and After Boiling.—Place 100 c.c. or 1000 grains of the water in an accurately stoppered 8 oz. bottle. Run in the soap solution from a burette in small quantities at a time. If the water be soft not more than 1 c.c. or 10 grains at a time, if hard, in larger quantities at first. After each addition, shake the bottle vigorously for about a quarter of a minute. As soon as a lather is produced, lay the bottle on its side after each addition, and observe if the lather remains permanent for five minutes. To ascertain this, at the end of five minutes, roll the bottle half-way round; if the lather breaks instead of covering the whole surface of the water, it is not permanent; if it still covers the whole surface, it is permanent: now read the burette.

Repeat the experiment, adding the full quantity of soap solution employed in the first experiment, less about 2 c.c. or 20 grains; shake as before, add soap solution very gradually

till the permanent lather is formed: read the burette, and take out the corresponding hardness from the table. If magnesian salts are present in the water the character of the lather will be very much modified, and a kind of scum (simulating a lather) will be seen in the water before the reaction is completed. The character of this scum must be carefully watched and the soap test added more carefully, with an increased amount of shaking between each addition. With this precaution it will be comparatively easy to distinguish the point when the false lather due to the magnesian salts ceases, and the true persistent lather is produced.

If the water is of more than 16° of hardness, mix 50 c.c. or 500 grains of the sample with an equal volume of recently boiled distilled water which has been cooled in a closed vessel, and make the determination on this mixture of the sample and distilled water. In this case it will of course be necessary to multiply the figures obtained from the table by 2.

To determine the hardness after boiling, boil a measured quantity of the water in a flask briskly for half-an-hour, adding distilled water from time to time to make up for loss by evaporation. It is not desirable to boil the water under a vertical condenser, as the dissolved carbonic acid is not so freely liberated. At the end of half-an-hour, allow the water to cool, the mouth of the flask being closed; make the water up to its original volume with recently boiled distilled water, and, if possible, decant the quantity necessary for testing. If this cannot be done quite clear, it must be filtered. Conduct the test in the same manner as described above.

The hardness is to be returned in each case to the nearest half degree.

10. Total Solid Matters.—Evaporate 250 c.c., or, say, $\frac{1}{20}$th gallon, in a weighed platinum dish on a water-bath, dry the residue at 220° F., and cool under a dessicator; weigh the dish containing the residue accurately, and note its colour and appearance and especially whether it rapidly increases in weight; return to the water-bath for half-an-hour and reweigh until it ceases to lose weight, then gradually heat it to redness, and note the changes which take place during this ignition. Especially among these changes should be observed the smell, scintillation, change of colour, separation of more or less carbon, and partial fusion, if any. The ignited residue is to be used for the estimation of phosphoric acid as before directed.

11. Microscopical Examination of Deposit.—The most convenient plan of collecting the deposit is to place a circular microscopical covering glass at the bottom of a large conical glass holding about 20 ozs. The glass should have no spout, and should be ground smooth on the top. After shaking up the sample, this vessel is filled with the water covered with a plate of ground glass and set aside to settle. After settling, the supernatant water is drawn off by a fine syphon, and the glass bearing the deposit lifted out, either by means of a platinum wire, which should have been previously passed under it, or in some other convenient way, and inverted on to an ordinary microscopical slide for examination. It is desirable to examine the deposit first by a $\frac{1}{4}$th and then by a $\frac{1}{8}$th objective. The examination should be made as soon as the water has stood overnight. If the water be allowed to stand longer, organisms peculiar to stagnant water may be developed and mislead the observer. Particular notice should be taken of bacteria, infusoria, ciliata or flagellata, disintegrated fibres of cotton, or linen, or epithelial debris.

It is particularly desirable to report clearly on this microscopical examination, not merely giving the general fact that organisms were present, but stating as specifically as possible, the names or classes of the organisms, so that more data may be obtained for the application of the examination of this deposit to the characters of potable waters.

It is also desirable to examine the residue left on a glass slide by the evaporation of

a single drop of the water. This residue is generally most conveniently examined without a covering glass. The special appearances to be noticed are the presence or absence of particles of organic matter, or organised structure, contained in the crystallized forms which may be seen, and also whether any part of the residue left, especially at the edges, is tinted more or less with green, brown, or yellow.

In connection with the microscopical examination it will also be desirable to adopt the sugar process, described by Mr. Heisch, as follows:—

12. Sugar Test.—The name of this process relates simply to the reagent which is used, namely, pure crystallized sugar. It is believed to be a test for the presence of the germs or spores of the sewage fungus. This special form of fungus grows very rapidly in water containing even a small admixture of sewage water, especially if sugar be present. It grows as well in a closed bottle of the liquid being tested, as in water exposed to the air, and even better in an atmosphere of carbonic acid.

To apply the test: Take a 5-ounce stoppered bottle which has been thoroughly cleaned and rinsed with the water to be tested. Fill with the water to be examined, add about 10 grains or say ·5 grammes of crystals of pure sugar, insert the stopper, and put the bottle in a good light, keep it at a temperature of as nearly as possible 80° F. The water should be free from suspended matters before the experiment is made.

The bottle must be carefully examined after two or three hours, and again if necessary at intervals. The fungus appears first in the form of minute floating white specks which are generally easily visible to the naked eye in a good side light when the bottle is looked at against a black background. A pocket lens may sometimes be used with advantage.

If any suspected speck is seen it must be caught by a fine pipette and transferred to a glass slide, covered, and examined with a ¼ objective and B eyepiece.

When first seen, these specks are found to consist of small isolated cells with a bright nucleus. In the second stage the form resembles a bunch of grapes. The bright nucleus is still seen. This second stage generally takes not more than four to six hours for full development. A few hours after the second stage has become clear, the cells assume the form of moniliform threads. After this they assume the form of ordinary mycelium, with sparsely diffused cells. Finally the cells disappear and leave only ordinary mycelium.

When the proportion of sewage is large, it is often accompanied by a distinct smell of butyric acid.

A few experiments on mixtures of small proportions of sewage matter with water will give sufficient data to enable this peculiar fungus to be readily recognised.

The following is the form in which the analysis should be reported:—

	Grains per gallon.
Description of sample.	
Drawn.	
Temperature when drawn.	
Appearance in two foot tube.	
Smell when heated to 100° F.	
Chlorine in Chlorides.	
Phosphoric Acid in Phosphates.	
Nitrogen in Nitrates.	
Ammonia.	
Albuminoid Ammonia.	
Oxygen absorbed in 15 minutes at 80° F.	
,, ,, 4 hours ,,	
Hardness before boiling (Clark's scale).	
,, after ,, ,,	
Total solid matter dried at 212° F.	
Microscopical examination of deposit.	
Remarks.	

INSTRUCTIONS FOR WATER ANALYSIS.

FACTORS FACILITATING CALCULATIONS.

Substance determined.	Water taken.	Volume or Weight obtained.	Factor to get grs. per gall.	Decimal place to which result to be reported.
Chloride	100 c.c.	Silver Sol. c.c.	0·7 = Chlorine.	Second.
„	1400 grains.	Silver Sol. grains.	0·05 = Chlorine.	
Nitric Acid, Crum's Process	250 c.c.	N_2O_2 c.c.	0·175 Nitrogen.	Second.
„ „ „ „	3500 grains.	N_2O_2 c.c.	0·193 Nitrogen.	
„ „ Copper Zinc..	100 c.c.	NH_3 grammes.	576·45 Nitrogen.	
„ „ or Aluminum	50 c.c.	NH_3 grammes.	1152·9 Nitrogen.	
„ „ „ „	1-40th gall.	NH_3 grains.	32·94 Nitrogen.	
„ „ „ „	1-70th gall.	NH_3 grains.	57·64 Nitrogen.	
Free and Albuminoid Ammonia......	500 c.c.	NH_4 Cl. Sol. c.c.	0·0014 NH_3	Fourth.
	7000 grains.	NH_4 Cl. Sol. grains.	0·0001 NH_3	
Oxygen absorbed	250 c.c.	10 c.c. Permang. used.	0·28 $(1-\frac{B}{A})$.	Third.
„ „	250 c.c.	15 c.c. Permang. used.	0·28 $(1{\cdot}5-\frac{B}{A})$.	
„ „	250 c.c.	20 c.c. Permang. used.	0·28 $(2-\frac{B}{A})$.	
„ „	3500 grains.	100 grains used.	0·2 $(1-\frac{B}{A})$.	
„ „	3500 grains.	150 grains used.	0·2 $(1{\cdot}5-\frac{B}{A})$.	
„ „	3500 grains.	200 grains used.	0·2 $(2-\frac{B}{A})$.	
Total Solids	250 c.c.	Grammes.	280 Total solids.	First.
„ „	3500 grains.	Grains.	20 Total solids.	

* A = c.c. or Grains of Hyposulphite solution corresponding to 10 c.c or 100 grains Permanganate.
B = „ „ „ „ „ used after 15 minutes or 4 hours action.

INSTRUCTIONS TO BINDER.—Bind this opposite page 138.

THE ANALYST.

AUGUST, 1881.

SOCIETY OF PUBLIC ANALYSTS.

An Extraordinary General Meeting was held at Burlington House on the 27th June; the President, Mr. Heisch, in the chair, for the purpose of considering the desirability of giving power to the Council to *nominate* Foreign Members for election by ballot. It was proposed by Mr. Wigner, Secretary, seconded by Mr. Lyte, Secretary, that the following be inserted in the Rules of the Society at page 2, line 5 from top, after "personal knowledge":

"Except in the case of any candidate not residing in Great Britain or Ireland, in which case a majority of two-thirds of the Council present at any meeting may *recommend* the candidate to the Society for election."

The motion was put to the meeting and carried unanimously.

A Special Meeting was then held.

The minutes of the meeting held on 1st June were read and confirmed.

The following gentlemen were proposed as members, and will be ballotted for at the country meeting:—Mr. C. Girard, Public Analyst for Paris, and Mr. C. T. Kingzett, Analytical Chemist, F.C.S., F.I.C.

Mr. Heisch read a further paper "On the Swedish Laws for the Sale of Poisons."

Dr. Wallace sent for inspection by the members of the Society a Certificate by the Government Chemist at Stockholm, of a test for Arsenic in a carpet, together with the tube containing the result of the test, and a piece of the carpet. This certificate had been translated, and a copy of the translation will be found on another page.

The following papers were also read: "On the Figures or Patterns which Drops of various Fats assume under certain Conditions," by A. Wynter-Blyth, M.R.C.S.

"On the Estimation of Quinine in Wines, Tinctures, &c.," by A. Wynter-Blyth, M.R.C.S.

"On a Modification of Wynter-Blyth's Apparatus for Digestions in Ether, as applied to Milk Analysis," by W. F. K. Stock, F.C.S., F.I.C.

"On a New Burner for Griffin's Gas Muffle Furnace," by W. F. K. Stock, F.C.S., F.I.C.

"Note on the Determination of Nitrogen as Nitrates," by S. Harvey, F.C.S.

"On the Detection of Lead in Waters by Potassium Bichromate," by S. Harvey, F.C.S.

NOTE ON THE ISOLATION OF STRYCHNINE.

By Alfred H. Allen.

Read before the Society of Public Analysts, on 11th March, 1881.

Chemists who are in the habit of employing ether and chloroform for the separation of alkaloids and other active principles from aqueous liquids, will have noticed a marked difference in their behaviour. In the case of ether, the layer of solvent either separates in

a few seconds from the aqueous liquid, or can be induced to do so with absolute certainty by adding more ether or by thoroughly cooling the liquid. I have never met with an instance in which ether refused to separate very rapidly, provided that it was used in such quantity that the etherial layer fully equalled in bulk the lower aqueous stratum.

The behaviour of chloroform exhibits a great contrast with that of ether; frequently many hours, and occasionally days, being requisite for its separation from the aqueous layer, and for the coalescence of the chloroform globules. Even then it not unfrequently has a milky appearance, which is rarely if ever noticed in the case of ether.

Some operators by preference employ chloroform rather than ether in cases where either liquid is equally suitable, as it is in the isolation of quinine. This preference is probably generally due to the supposed advantage obtained by the greater density of chloroform, which causes its collection below instead of at the surface of the aqueous layer. In certain other cases, however, there is the far stronger reason that chloroform is a greatly superior solvent for the substance to be extracted. Strychnine forms a notable instance of this, being variously stated to require from 340 to 1800 parts of ether, but only 7 to 10 parts of chloroform for solution. Nevertheless, and doubtless in consequence of the trouble and delay in the separation of a chloroformic layer, Dr. Tidy and other eminent toxicologists recommend the use of ether instead of chloroform for the isolation of strychnine.

I have myself, till lately, been in the habit of employing ether for the same reason, but now use a solvent which unites a high solvent power for strychnine with the property of ready separation from the aqueous liquid. This consists of a mixture of equal volumes of chloroform and ether. Such a mixture has a density of about 1·10, and hence is sensibly heavier than most aqueous liquids. I have however, recently employed it with solutions so largely loaded with sugar that the solvent mixture floated on the surface; nevertheless, the separation occurred with great facility. In cases where the aqueous liquid approximates very closely in gravity to the solvent, separation can be readily induced by adding water (or better, ammonia). Of course, an additional quantity of chloroform or ether may also be added, but if the former be employed in notable excess the facility of separation is apt to be materially impaired, whilst if ether be added in considerable quantity the solvent power of the mixture for strychnine is materially reduced. That this last objection, however, has no great weight is proved by the following results of experiments made by my pupil, Mr. Charles Harrison, to test the point.

One gramme of commercial strychnine was dissolved in acidulated water, and the solution diluted to 100 c.c.

Experiment I.—10 c.c. measure of the above solution (= ·100 gramme strychnine) was treated with excess of ammonia, and the liquid agitated with 10 c.c. of a mixture of equal bulks of chloroform and ether. On drawing off and evaporating the solvent, exactly ·100 gramme residue was obtained. On again agitating the alkaline liquid with ether-chloroform, an additional weight of ·004 gramme was extracted.

Experiment II.—A repetition of the above experiment gave ·087 gramme by the first extraction, and an additional ·019 gramme on re-agitating, thus making a total of ·106 gramme dissolved.

These experiments sufficiently prove that the solubility of recently precipitated

strychnine in ether-chloroform is amply sufficient to ensure its solution in practice. It will be observed that the weights of the total residues obtained somewhat *exceeded* the original weights of the alkaloid employed. This fact is doubtless due to the strychnine as dried for a short time at 100° C., retaining some water of combination. I propose to examine this matter more fully. It was found that when the solution of the strychnine in ether-chloroform approached dryness, it was exceedingly apt to decrepitate, thus occasioning loss of alkaloid. This tendency was avoided by adding a few drops of alcohol towards the close of the evaporation. This precaution is only necessary when perfectly pure strychnine is in solution. The small quantity of impurity usually extracted along with the strychnine when the method is used in toxicological investigations, appears to prevent the tendency to decrepitation. In the extraction of strychnine in such practice, I find it convenient to bring the acidulated aqueous liquid to a volume of about 20 c.c., agitate it with ether-chloroform to remove piperine, glucosides, &c., separate, render the liquid strongly alkaline with ammonia, and at once agitate with 30 c.c. of ether-chloroform. The separation usually occurs very rapidly, but may be induced with certainty by adding water or ether in the manner already described.

ON THE SWEDISH LAWS FOR THE SALE OF POISONS.

By C. Heisch, F.C.S., F.I.C.

Read before the Society of Public Analysts, on 27th June, 1881.

You will remember that when I brought before you an abstract of the Swedish decrees on the sale of poisons, I drew your attention to the fact that, though the production of a brown or black arsenical mirror in a tube of 2 m.m. diameter, from 50 Swedish square inches of paper hangings, or 25 of textile fabrics was said to be enough to prohibit the sale of such goods, no hint was given as to the process by which such mirror was to be produced, nor of the quantity of arsenic it was supposed to represent. Since that time I have endeavoured to determine what is the smallest quantity of arsenic which will produce such a mirror, and as no process was mentioned, I used what I thought the best, the modification of Marsh's test, in which the arseniuretted hydrogen is passed through a red hot tube, and the arsenical mirror produced in the tube just beyond the red hot portion. I place before you three tubes. No. 1, diameter $\frac{1}{4}$-inch, contains arsenic from ·001 gr. AS_2O_3. No. 2, $\frac{1}{4}$-inch diameter, arsenic from ·00116 AS_2O_5, the same amount of arsenic as No. 1. No. 3, one-tenth inch diameter, the same amount of arsenic. Even this last is one-fifth larger than the Swedish tube, yet the arsenical mirror is absolutely opaque. How much farther one could go I cannot quite say, but half the above quantity gives not only a perceptible mirror, but when sublimed on to a micro-slide a good crop of octahædral crystal of AS_2O_3. The only difference I can find in the results from AS_2O_3 and AS_2O_5 is that while ·001 AS_2O_3 is all reduced and deposited in half-an-hour, ·001 AS_2O_5 takes over two hours for complete reduction. Professor Sell, of Stockholm, when asked what process was intended by the decree of November, 1879, replied that he could not say any particular process was ordained, but he should treat the sample with either H_2SO_3, or fuming nitric acid, wash and precipitate with H_2S, and reduce with NA_2CO_3 and KCy. This would certainly not give such good results with small quantities as the Marsh test, and take much more time and trouble.

A few days since we received from Dr. Wallace, of Glasgow, for exhibition to-night, a sample of carpet which had been condemned by the analyst in Stockholm, with the certificate and tube of arsenic attached, as directed by the act. A translation of this certificate I place before you, the parts in ordinary type being the official printing, those in italics the filling in for this particular article. On the certificate is the description of the process employed, which is much that contained in Professor Sell's letter, but more detailed. Dr. Wallace also gives us the process as described to him by the owner of the carpet, which is the same as that on the certificate, with this addition, that the fact of the mirror being enough to condemn the carpet was judged by observing if a black line on a white ground could be seen through it: if it could not the sale of the article was prohibited I may mention that according to the best evidence we have been able to obtain, no injurious effects have yet been traced to a paper hanging containing as little as ·5 grains per piece of nine square yards, but beyond this it is not safe to go. This would correspond to ·001 grain in 16 square inches, and from that quantity we can, as you see, obtain an opaque mirror. In Sweden 50 Swedish square inches or 68 English are employed, and an opaque mirror condemns the article. If, however, the process mentioned on the certificate shown be universally employed, probably much larger quantities would be required to produce the same mirror as we obtain by Marsh from ·001 grain. Dr. Wallace mentions that he cannot obtain satisfactory results by following the Swedish method, at which I think no one will be surprised. You will observe that on the certificate the fee, 3-50 is mentioned as the official one. This means 3 krona 50 öre, or 3 krona and a-half, the value of the krona is 1/1, so the fee is 3/9½. This beats our adulteration fee hollow, but I suppose money goes farther in Stockholm.

BUREAU OF TECHNICAL CHEMISTRY, STOCKHOLM,
40, DROTTNINGGATTEN (QUEEN STREET), 40.

At the Bureau of Technical Chemistry was left on *the 8th instant by Messrs. H. I. Heymann & Co., of Gothenburg, a sample of so called tapestry carpet of various colours, the remainder of which is attached hereto.*

To be examined for the presence of arsenic.

The result of the Chemical Analysis was as follows :—

Size of piece operated on *25 square inches.*

That according to the present poison regulations, the trade in the same is forbidden.

The glass tube attached hereto is that in which the arsenical mirror was received.

The examination was carried out by breaking up the sample with fuming nitric acid and washing the mass with water, precipitating the heavy metals with sulphuretted hydrogen after concentration. Treating the precipitated sulphides with caustic ammonia, evaporating the solution so obtained to dryness, and reducing the residue with soda and cyanide of potassium in a stream of carbonic acid on the Von Babo-Fresenius method. All the reagents used have been found by me free from arsenic, which I hereby declare.

Trades Chemist in Stockholm,
A. WERNER CRONQUIST.

Reference No. *7521.*
Analysis No. *30,170.*
Fee according to prescribed tariff, *3-50.*

The following is the mode of testing for arsenic in textile fabrics, &c., by the Swedish

Government Analyst, as ascertained by a carpet manufacturer who recently visited Stockholm, and forwarded to the Society, together with the original certificate, by Dr. Wallace.

The sample is dissolved by means of fuming nitric acid and the result (after evaporation) washed (dissolved) in water; the heavy metals are precipitated by sulphuretted hydrogen, and the sulphides obtained are treated with ammonia, and the solution thus obtained is evaporated to dryness and reduced by means of soda (carbonate) and cyanide of potassium in a stream of carbonic acid gas.

The arsenic is reduced to the metallic state in a glass tube, the diameter of which must not exceed 2 millimetres.

220 square centimetres are operated upon, equal to 25 square inches Swedish, or 34 square inches English. If the glass (tube) is not transparent, so that a black line on white ground (such as a black line on writing paper) may not be seen through it, the goods are prohibited. The carpet in question contained about half a millegramme in 220 square c.m., or say about 1-20th of a grain in a square foot (Swedish).

ON A MODIFICATION OF WYNTER-BLYTH'S APPARATUS FOR DIGESTIONS IN ETHER AS APPLIED TO MILK ANALYSIS.

By W. F. K. Stock, F.C.S., F.I.C.

Read before the Society of Public Analysts on 27th June, 1881.

Owing to the rapid diffusion of heat through cast iron, and the difficulty found in retarding this diffusion when working with thin sections, coupled with the obvious difficulty of applying Wynter-Blyth's original apparatus to the use of platinum basins of conveniently small size, I have adopted the following simple modification. The concave iron vessel is replaced by a flat iron casting, which may be either rectangular or circular. This plate is one inch thick by six inches square or diameter. In one side a half-inch groove is *turned*, not cast, to form a seat for the welted edge of a narrow tubulated bell-jar, convenient dimensions for which are 7 inches high by 4½ inches diameter, ¾ inch tubulure. This bell-jar is fitted with a long, light, Liebig's Condenser, having a water jacket 20 inches long by 1 inch diameter, with an inner tube of ¼ inch bore.

The clearest conception of the use of this apparatus will perhaps be gained if I describe a fat determination by my present method.

10 grms. or so of milk are evaporated in a platinum basin 2¼ inches wide by ¾-inch deep. This is done on the water-bath, and requires about an hour and a quarter. The basin and residue is placed in a 10-ounce beaker, 60 c.c. of dry ether are poured over it, and the beaker is of such a size that the ether covers the basin to the depth of nearly half-an-inch. The beaker and contents is placed within the groove on the cast iron plate, the bell-jar with condenser attached is turned over it, sufficient mercury is run into the groove to give a perfect seal, a stream of water is sent through condenser, and the whole is best left for a night. In the morning a low gas jet is placed under the plate, which stands on a strong tripod, and the ether is allowed to boil gently for an hour or more. A weighed beaker having been got ready, the gas is turned out, bell-jar removed, and the ether carefully decanted into the weighed beaker, the basin being first lifted and drained by

means of a pair of bright brass tongs. This is repeated three times, boiling for fifteen minutes each time. The remaining operations require no description. In practice I have three of these arrangements standing on one bench, and the same stream of water feeds them all. Of course they must be well apart for fear of accidental ignition of the vapour of the ether.

There is an advantage in having the beaker to contain the basin, which is not at first seen, but anyone using this apparatus would soon discover it. It is that the ether in the beaker boils more rapidly than that in the basin, and the point of the condensing tube being ground off obliquely and directed to the centre of the platinum basin, there is a constant wash of pure dry ether, which rapidly displaces the contents of the basin, and tends largely to the proper and perfect solution of the fat.

The following trials have been made with the apparatus.

60 c.c. ether have been *boiled* for three hours continuously. Loss = 10 c.c. This was in winter.

Check Fats on milk gave:—

	No. 1.	No. 2.	No. 3.
Fat =	2·61	2·61	2·61

Another sample analysed by two operators at a distance. Methods unknown to each other.

	Wynter-Blyth modified.	Unknown.
Fat =	2·48	2·51

Difference: ·03 per cent.

For the information of analysts disposed to try the modification, I may just add that the plates cost 4/0 each with groove turned out, bell jars 1/6 each, indiarubber corks for condenser, 6d. Tripods and condensers were made at home in my case, the latter being got out of old water analysis condensers.

NOTE.—I tried on several occasions to recover the ether, but I rapidly came to the conclusion that the loss of the solvent was the truest economy.

In the discussion which ensued, Mr. Wynter-Blyth said that he had never proposed his apparatus for milk, he rather proposed it as a useful thing in the laboratory; he himself used Soxhlett's milk apparatus now. He found his own apparatus very useful for miscellaneous purposes; he used it for the recovery of ether more than anything else, especially when the ether was in small flasks, and could be put into this apparatus without any cork and distilled over.

ON THE DETECTION OF LEAD IN POTABLE WATERS BY MEANS OF POTASSIUM BICHROMATE.

By SIDNEY HARVEY.

Read before the Society of Public Analysts, on 27th June, 1881.

THE dark color struck by hydrogen sulphide in samples of water suspected of metallic impregnation may be due to lead, copper, tin, and possibly other metals, and as the tone and intensity of tint produced by this re-agent varies in the case of the three metals above named, it becomes important before attempting any colorimetric estimation by means *of standard solutions* to decide which metal is really present.

I have been in the habit for a considerable time past of employing bichromate of potash for the identification of lead and consider it to be the most efficient and delicate test for the purpose as well as very simple and easy in the mode of application.

The following experiments have been undertaken to prove this :—

Taken—Standard solution of lead acetate, strength 0·1 milligram metal in 1 c.c.

—Canterbury water works water.

—Small crystals of potassium bichromate, potassium iodide and sodium sulphate.

Phillip's precipitating jars were used in every case.

Experiment 1.—143 c.c. standard lead made up to 1 litre with the water and divided into three portions. Strength, 1 grain of metal per gallon.

Sodium Sulphate.—Solution still bright in 24 hours. A very slight and doubtful deposit at bottom of glass.

Potassium Iodide.—Incipient yellow scales in half an hour. A complete deposition in 12 hours of yellow plumbic iodide.

Potassium Bichromate.—Immediate and very dense turbidity, precipitating in six hours, covering bottom of glass and considerable in amount.

Experiment 2.—28·6 c.c. standard lead in 1 litre water (strength 1-5th grain in gallon).

Potassium Iodide.—Clear and colorless solution 24 hours after. Slight trace of scales of iodide at bottom, but hardly visible.

Potassium Bichromate.—Immediate and considerable turbidity, depositing precipitate in six hours.

Experiment 3.—14·3 c.c. standard lead in 1 litre water (strength, 1-10th grain per gallon).

Potassium Bichromate Crystals.—Very pronounced turbidity at once.

Experiment 4.—7·15 c.c. standard lead in 1 litre water (1-20th grain per gallon).

Potassium Bichromate Crystals.—Distinct turbidity in 15 minutes.

Experiment 5.—3 c.c. standard lead in 1 litre water (1-50th grain per gallon).

Potassium Bichromate Crystals.—Distinct turbidity in 30 minutes.

In all cases the jars used were set alongside similar jars containing water free from lead and tested in same manner.

In every case where bichromate was used and sufficient time was allowed for subsidence, the colored water could be poured off to the last drop without disturbing the lead chromate, which latter could then be shaken with a little distilled water and its color and properties better observed than when in a yellow fluid.

I consider it of great importance that the re-agent should be added to the water in crystals and not in solution. The former is for some reason far more prompt and delicate in its effects.

I also find that for the production of lead iodide (a very characteristic precipitate by the way) a large quantity of potassium iodide is required for dilute solutions of lead.

Sulphates are no bar to the detection of lead in water by bichromate. 10 c.c. standard lead (= milligram metal) were evaporated to dryness with sulphuric acid, heated to expel excess of latter. Residue moistened with dilute nitric acid, 5 c.c. water added, boiled and a little sodium acetate added. A crystal of bichromate added to the cleared solution gave an immediate precipitate of lead chromate.

To conclude, about ¼ litre of the water to be examined is brightened (if necessary) with a drop or two of acetic acid and agitated in a Phillip's precipitating jar with a few minute crystals of potassium bichromate. Lead, if present in the proportion of 1 part in 3½ millions, will be detected by the yellow turbidity or precipitate produced.

THE PUBLIC WATER SUPPLIES OF ENGLAND.

VALUATION, ACCORDING TO WIGNER'S VALUATION SCALE, OF THE ANALYSES PUBLISHED THIS MONTH.

In compliance with the wish of many analysts we have decided to publish for the next six months the valuation of all the waters, the analyses of which appear in this journal, so as not only to enable the valuation scale itself to be put to a crucial test, but to give a clear indication of the variations which occur from time to time in the different waters.

In the following table we give the *average* valuation of the public supplies from January to June—the valuation of the analyses published last month (the June waters) and of those published this month (the July waters). We purpose using the January to June average valuation as a standard of calculation of improvement or deterioration, as the case may be, until the end of the present year.

	Average to June.	June.	July.		Average to June.	June.	July.
Kent Co.	30	23	27	Liverpool	36	34	29
New River	26	18	17	Llandrindod	13	..	..
East London	32	36	39	Maidstone Water Company	39	42	34
Southwark and Vauxhall	34	30	28	,, Public Conduit	36	40	28
West Middlesex	30	31	24	Manchester	22	19	17
Grand Junction	30	25	23	Newark	39	..	46
Lambeth	37	29	29	Newcastle	37	38	40
Chelsea	39	26	26	Norwich	36	32	49
Bath	12	11	19	Nottingham	39	32	46
Birmingham	33	33	37	Oldham	23	..	..
Bradford	53	58	81	Plymouth	29	..	..
Brighton	24	26	23	Portsmouth	30	27	22
Bristol	22	19	27	Reading	25	20	20
Cambridge	28	29	26	Rochdale	9	8	7
Canterbury	17	15	22	Rugby	41	58	..
Croydon	27	28	30	Salford	18	21	14
Derby	18	14	13	Sheffield	22	..	..
Droitwich	39	..	..	Shrewsbury	23	18	..
Dudley	45	..	..	Southampton	43	..	..
Edinburgh	28	25	21	Stockport	17	..	..
Exeter	20	18	16	Stourbridge	37	..	..
Grantham	27	30	..	Stourport	37	..	..
Huddersfield	23	20	26	Sunderland	25	..	27
Hull	23	20	..	Swansea	16	12	14
Ipswich	27	27	30	Warwick	34	..	34
King's Lynn	94	131	110	Whitehaven	9	11	17
Leamington	26	21	..	Wolverhampton	46	42	39
Leeds	35	34	28	Worcester	55	..	..
Leicester	42	30	24				

Taking the Metropolitan waters first, we find that the Kent company gives a figure slightly worse than last month, but better than the average. The New River water shows an improvement over last month, and a considerable improvement over the average. The East London is worse than last month, and no less than 7 on the valuation scale worse than the average, although even now it falls within the limit of first-class waters.

The Southwark and Vauxhall, West Middlesex, and Grand Junction all show an improvement—most marked in the West Middlesex sample—whilst the Lambeth and Chelsea waters are practically identical in value with those published last month.

Taken as a whole, the average valuation of the London supplies for July is 27, a figure *which contrasts very satisfactorily* with a large number of the analyses published from places

where the facilities for obtaining water are greater than in the case of the Metropolis. The figure shows that the London water, as a whole, is of good quality.

Dealing next with the provincial supplies, the lowest and, therefore, most satisfactory figures of valuation are those of Rochdale, 7; Derby, 13; Salford, 14; Swansea, 14; Exeter, 16; Manchester, 17; Whitehaven, 17; Bath, 19; Reading, 20. Of these nine waters, seven show a distinct improvement in the supplies of last month, and two—viz., Bath and Whitehaven—show a slight deterioration. In the Bath analysis the deterioration is shown mainly by the presence of algæ and diatoms accompanied by slight increase in the albuminoid ammonia. In the Whitehaven analysis the increase is due almost entirely to a marked change in the albuminoid ammonia, which, although still low, stands at a figure twice as high as last month.

There are eight other samples which show improvements on last month, and on the average of the previous six months, viz., Brighton, Cambridge, Edinburgh, Leeds, Leicester, Liverpool, Maidstone, and Wolverhampton; and in seven of these the improvement is of importance. In Edinburgh the decrease of valuation is 7; in Leeds, 6; in Leicester and Liverpool, 5; in Maidstone, 6; and Wolverhampton, 7.

Croydon, Ipswich, Newcastle and Sunderland show very little change.

There are six places where the character of the July supply appears to be worse than that of the previous month. Birmingham has an increased valuation of 4, Bristol of 8, Canterbury of 7, Huddersfield of 6, Newark of 14, Norwich of 17—and here the valuation is the highest yet recorded for that city. Nottingham has an increase of 14, but the valuation is not quite so high as in April and May. The supply of this town appears to be very variable in character. King's Lynn shows the highest valuation in the whole series, as, indeed, has generally been the case month by month. It is some slight satisfaction to note that the degree of impurity for July is somewhat less than it was in June, although still so high that the water must be ranked as at least third class.

ERRATA.—On page 122 in the paper on the Water Valuation Scale, the decimal point in the figure for Chlorine is omitted. It should have been ·50 grains per gall. = 1.

THE ANALYSES OF THE PUBLIC WATER SUPPLIES OF ENGLAND.

Bolton.—This borough and its suburbs are supplied with water by gravitation from three sources, viz., Belmont, Heaton, and Entwistle. The drainage area extends over about 3166 acres; and the water is collected in five reservoirs, the total capacity of which is 940,500,000 gallons. The geological formations of the districts consist of the shales and sandstones, which constitute the lower portion of the coal series, and upper millstone grit. The average annual rainfall at Belmont and Entwistle is 55 inches, and at Heaton 45; the average amount of water which may be collected being about 40 inches. The present water supply is 5,200,000 gallons per diem. The sample analysed (see table of July waters) is a mixture, as supplied, from all the three sources, and may be taken as fairly representing the water now supplied to the consumers. Filtering beds are now (Aug., 1881) being constructed by the Corporation.

Hastings and St. Leonards.—The public supply of these towns is almost entirely obtained from wells ranging from 90 ft. to 350 ft. in depth, connected into sets of 3 or 4 each by headings. This supply is practically continuous, it being pumped into reservoirs (about sufficient for two days) and then conveyed to the service pipes. Some of the waters containing iron are first pumped into ærating and filtering beds to free them. There are chalybeate springs in the neighbourhood. A little surface water is used, but this, though of fair quality, is being gradually dispensed with by sinking new wells in the districts where the purest water is found.

SOCIETY OF PUBLIC ANALYSTS.

Analyses of English Public Water Supplies in July, 1881. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Date when drawn.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine in Chlorides.	Phosphoric Acid in Phosphates.	Nitrogen in Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in 2 mins. at 80° Fahr.	Oxygen, Absorbed in 4 hours at 80° Fahr.	Hardness, Clark's Scale, in degrees. Before Boiling.	Hardness, Clark's Scale, in degrees. After Boiling.	Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
Kent Co.	July 19	pale blue	none	1·56	traces	·538	·0002	·0054	none	·0080	16·4°	5·6°	23·4	none	Wigner & Harland.
New River	„ 15	clear	none	1·14		·147	·0014	·0021	·0020	·0220	13·5°	2·0°	17·64	satisfactory	B. Dyer.
East London ..	„ 15	c. green. yellow	none	1·16	traces	·173	·0012	·0132	none	·0500	15·0°	3·6°	19·40	satisfactory	Wigner & Harland.
Southwark & Vauxhall ..	„ 18	c. f. yellow	none	1·24	trace	·090	·0014	·0070	·0028	·0476	13·5°	3·5°	17·64	satisfactory	J. Muter.
West Middlesex	„ 20	f. greenish yelw.	none	1·05	trace	·081	·0007	·0034	none	·0560	12·2°	2·1°	17·22	satisfactory	O. Hehner.
Grand Junction	„	pale yellow	none	1·04	trace	·096	none	·0047	·0012	·0424	12·6°	2·8°	18·40	satisfactory	A. Wynter-Blyth.
Lambeth	„ 19	c. f. yellow	none	1·24	trace	·090	·0007	·0070	·0028	·0560	14·0°	4·5°	18·76	satisfactory	J. Muter.
Chelsea	„ 13	c. greenish yelw.	none	1·26	trace	·140	·0010	·0050	·0040	·0450	13·0°	2·5°	17·64		A. Dupré.
Bath	July 15	c. f. blue	none	·96	none	·185	none	·0008	none	none	16·0°	4·0°	23·04	algæ & diatoms	J. W. Gatehouse.
Birmingham ..	„ 4	s. tur. grn. yelw.	none	1·19	traces	·139	·0021		·0080	·0740	12·2°	4·1°	18·50	veg. particles	A. Hill.
Bolton........	„ 5	s. yellow turbid	none	·40	none	·029	·0014	·0056	·0030	·0228	3·0°	3·0°	6·12	mineral & veg. debris	W. H. Watson.
Bradford	„ 15	s. peaty yellow	none	·65	none	none	none	·0056	·0460	·2110	3·4°	3·2°		none	F. M. Rimmington.
Brighton	„ 8	c. yelw. green	none	1·99	traces	·368	·0011	·0016	none	trace	12·8°	3·8°	20·60	vegetable debris	Wigner & Harland.
Bristol	„ 11	f. green	none	1·10	trace	·050	·0010	·0014	·0020	·0100	14·6°	1·8°	18·40	none	F. W. Stoddart.
Bury (Lan.) ..	„ 11	turbid	mossy	·95	none	·034	·0040	·0092	·0070	·0246	4·4°	4·2°	7·04	veg. debris & minl. mttr.	W. H. Watson.
Cambridge	„ 4	c. pale blue	none	1·34	traces	·384	·0005	·0010	·0028	·0582	17·8°	4·0°	24·50	satisfactory	J. West-Knights.
Canterbury	„ 20	c. pale blue	none	1·47	none	·412	·0005	·0007	·0050	·0110	17·0°	4·6°	23·66	very slight mineral	S. Harvey.
Croydon	„ 20	c. colourless	none	1·12	trace	·335	none	·0050	none	·0084	15·5°	6·0°	23·40	none	C. Heisch.
Darlington	„ 20	c. green. yelw.	s. peaty	·70	trace	·022	·0007	·0035	·0210	·2040	7·4°	4·4°	10·92	none	W. F. K. Stock.
Derby	„ 20	v. good	none	1·05	trace	·096	·0014	none	trace	·0092	10·1°	5·0°	19·18	satisfactory	L. Archbutt.
Edinburgh	„ 18	s. brown	none	·76	none	trace	·0008	·0048	·0096	·0448	4·7°	3·9°	5·76	none	J. Falconer King.
Exeter........	„ 5	f. greenish yelw.		·91	trace	·127	none	·0035		·0217	2·8°	2·8°	5·60		F. P. Perkins.
Hastings......	„ 12	v. p. yellow	none	4·5	none	·297	·0015	·0030	none	·0105	6·5°	3·5°	28·10	mineral matter	H. F. Cheshire.
Huddersfield ..	„ 14	f. yellow green.	v. faint	·55	none	·024	none	·0035	·0040	·0050	2·2°	2·0°	6·10	peat moving organisms	G. Jarmain.
Ipswich	„ 9	c. colourless	none	2·19	traces	·395	·0057	·0074	none	none	18·8°	8·6°	31·12	no deposit	J. Napier.
King's Lynn* ..	„ 13	turb. brn. yelw.	weedy	1·59	h. traces	·350	·0014	·0119	·0252	·2140	10·0°	5·5°	17·08	veg. debris diatoms	William Johnstone.
„	„ 14	turb. brn. yelw.	weedy	1·63	h. traces	·360	·0018	·0142	·0280	·2265	11·2°	5·8°	18·52	moving organisms	
Leeds	„ 1	light yellow	none	·62	none	none	·0005	·0044	·0140	·0730	4·0°	2·9°	5·04	peaty matter	T. Fairley.

SOCIETY OF PUBLIC ANALYSTS.

Analyses of English Public Water Supplies in July, 1881. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Date when drawn.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine in Chlorides.	Phosphoric Acid in Phosphates.	Nitrogen in Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in		Hardness, Clark's Scale, in degrees.		Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
									2 mins. at 80° Fahr.	4 hours at 80° Fahr.	Before Boiling.	After Boiling.			
Leicester......	July 19	f. yellow	none	1·15	trace	·103	·0013	·0032	·0027	·0745	7·7°	4·5°	14·44	satisfactory	W. L. Emmerson.
Liverpool	,, 18	yellow green	slight peaty	1·08	trace	·083	·0014	·0035	·0028	·0677	4·8°	4·5°	9·52	no deposit	A. Smetham.
Margate	June 28	c. blue	none	16·76	trace	·760	·0007	·0025	none	·0060	18·0°	10·2°	50·80	satisfactory	Wigner & Harland.
Maidstone—															
Wtr. Company	July 11	turbid	none	2·80	trace	·409	none	·0023	·0042	·0196	17·4°	5·6°	34·44	satisfactory	M. A. Adams.
Public Conduit	,, 11	clear	none	2·40	trace	·444	none	·0007	·0042	·0271	16·5°	5·6°	32·30	none	M. A. Adams.
Manchester....	,, 15	c. v. s. yellow	none	·73	none	none	·0033	·0045	·0032	·0439	2·0°	1·9°	5·73	satisfactory	W. Thomson.
Newark	,, 9	b. grn. s. turbid	none	1·75	trace	·026	·0022	·0074	none	·0689	17·0°	10·9°	34·24	diatoms and desmids	A. Ashby.
Newcastle-on-Tyne......	,, 8	f. yellow	none	·91	trace	·053	·0010	·0090	·0060	·1030	12·2°	4·7°	16·00	satisfactory	J. Pattinson.
Norwich	,, 16	p. greenish yelw.	none	2·10	trace	·061	traces	·0076	·0290	·0768	13·0°	4·0°	16·00	satisfactory	W. G. Crook.
Nottingham ..	,, 19	c. green. bluish	none	1·77	traces	1·000	·0005	·0047	none	none	15·0°	8·0°	20·60	vegetable fibres	Wigner & Harland.
Portsmouth ..	,, 13	clear	none	1·26	trace	·150	trace	·0014	none	none	13·4°	3·2°	14·50	decomp. veg. mttr. diams.	W. J. Sykes.
Reading	,, 13	c. greenish	none	·90	trace	·085	none	·0042	none	·0014	15·0°	4·0°	18·75	satisfactory	J. Shea.
Rochdale	,, 18	pale blue	none	·60	none	·008	·0015	·0028	none	·0004	3·4°	1·6°	5·00	satisfactory	T. A. Collinge.
Salford	,, 15	clear	none	·05	none	none	·0020	·0040	·0020	·0600	3·0°	2·5°	4·00	satisfactory	J. Carter Bell.
Sunderland ..	,, 16	c. colourless	none	1·85	trace	·288	·0023	·0030	·0020	none	9·6°	3·7°	24·50	vegetable debris	H. J. Yeld.
Swansea	,, 18	clear	none	·90	trace	none	·0010	·0056	·0030	·0040	2·5°	2·5°	3·57	none	W. Morgan.
Warwick	,, 8	greenish	none	1·40	trace	·231	·0007	·0028	·0170	·0390	18·4°	12·8°	21·70	none	A. B. Hill.
Whitehaven ..	,, 12	v. s. turb. p. grn.	none	·36	trace	·005	none	·0023	none	·0158	0·4°	0·4°	2·10	vegetable debris diatoms	A. Kitchin.
Wolverhampton	,, 12	s. yellow tinge	none	1·36	trace	·605	·0003	·0042	·0013	·0638	12·6°	6·4°	20·16	confervæ and diatoms	E. W. T. Jones.

Abbreviations:—c., clear; f., faint; h., heavy; p., pale; v. h., very heavy; v. s., very slight.

ERRATA.—In the June Table the Nitrogen in Nitrates in the Reading Water should have been ·088 instead of ·88, and in the Wolverhampton Water it should have been ·073 instead of ·051.

NOTE UPON DETERMINATION OF NITROGEN AS NITRATES, &c.

By Sidney Harvey, F.C.S.

Read before the Society of Public Analysts, on 27th June, 1881.

The figures appended to my successive reports upon the Canterbury water are *bona fide*, suspiciously close as they may appear. They have been determined with exceeding care, and illustrate, I think, the constancy and value of the aluminium process, which I have used for years and in which I have great confidence.

70 c.c. of water (or 7 c.c. diluted to 70 if nitrates are excessive in amount) are mixed with 20 c.c. of 10 per cent. caustic soda (free from N.) boiled to expel any free NH_3, cooled and aluminium in thin sheet introduced and left to stand overnight. Distilled next day and distillate (200 c.c.) nesslerized as usual (an aliquot portion of course). The flask in which the reduction takes place is closed with a cork pierced with a short length of thermometer tube, and is set in a place free from ammonia fumes and kept for that purpose.

Water Analysis.—If any of the Analysts engaged have used all the forms for the monthly reports and will send a line to the Secretaries, further copies will be sent to them.

Instructions for Water Analysis.—On page 135 we print a further part of these Instructions.

LAW REPORTS.

Adulteration of Milk :—

At the Belfast Police Court, Michael Marley and Francis M'Atamney were summoned at the instance of Wm. J. Anderson, sub-sanitary officer, for selling sweetmilk which was adulterated by water. Mr. James M'Lean, jun., prosecuted in this and the remaining cases. Mr. Harper appeared for the defendant. Mr. M'Lean said that this was about one of the worst cases of adulteration of sweet-milk that ever came before the Court since the Sale of Food and Drugs Act had come into force. The report of Dr. Hodges, the Borough Analyst, showed that in every 100 parts of milk there were 36 parts of water added as an adulterant. The second defendant was a servant of the first, and was selling the milk for him. He (Mr. M'Lean) thought that it was a case in which the full penalty of the statute should be inflicted. Mr. Anderson, having deposed to buying the milk and giving it to the analyst, said that the defendant Marley had been fined 40s. on a previous occasion for a similar offence. Captain Plunkett said that the public were defrauded by buying what they thought was a certain quantity of milk, and getting instead a quantity of milk and water. It appeared to him that a case of this sort should be in the other court, and not in the one it was. The defendant should be in the dock, as the offence was just the same as robbing a man in a clandestine manner. It was just the same with weights. The unfortunate public paid for one pound weight, and got a few ounces light, and the greater portion of them had no means of discovering it. The defendant Marley would have to pay a fine of £10 and costs, which was not a large sum, as it was only a matter of a few days' profit. The other case was dismissed.

John Grant was summoned for a similar offence. Mr. M'Erlean defended. The analyst's certificate showed that a similar quantity of water had been added as an adulterant. As it was the defendant's first offence, he was only fined 40s. and costs.

James Huddleston was also summoned by the same complainant for selling a quantity of butter-milk which contained 35 parts added water. A fine of 20s. and costs was inflicted.

Question raised as to whether analysis personally made by Public Analyst himself :—

At the Aston Police Court, William Lewis, jun., wholesale milk dealer, Fordrough, Potter's Hill, Aston, was summoned for selling milk adulterated with water. According to the certificate of Dr. Bostock Hill, the County Analyst, the milk which was purchased by Mr. Bolt, the Inspector of Nuisances, was adulterated with 27 per cent. of added water. Dr. Hill, who was present,

was put in the witness-box, and in reply to the cross-examination of Mr. Vachell, who defended, said he did not and could not do all the manual work connected with the analysis of every sample of milk. But he always superintended them, and was invariably in the laboratory when they were being made by his assistants. Mr. Vachell said although he did not wish for a moment to impeach the accuracy of the analysis, he still submitted that the conditions of the act had not all been complied with. The 12th and 13th sections provided that the analysis must actually be made by the analyst himself. It was not sufficient for him to have it made by others, however skilled they might be. The Bench said they were quite satisfied Dr. Hill had complied with all the requirements of the Act. He told them that he employed competent assistants, and they (the Bench) thought it would be unreasonable that he should be required to actually perform every detail himself—it would be utterly impossible. The defendant would be fined 40s. and costs. Mr. Vachell asked for a case. He said the point was of some importance to milk sellers in general. The Bench granted a case.

At the Town Hall, Leeds, lately, Mr. Bruce gave judgment in a case which was before him on the 15th March, and in which Jabez Smith Blanchard, provision dealer, Kirkdale, was summoned for selling as butter an article known as butterine. Mr. Beverley, barrister, who appeared for the defendant (having been instructed since the case was last before the Court), contended that as the defendant had affixed to the article which he sold a label intimating that it was butterine, he had complied with the Act as much as if he had labelled it as a "mixture." The Town Clerk (Mr. G. Morrison), who prosecuted on behalf of the Corporation, objected to Mr. Beverley addressing the Court after the case had been heard. Mr. Bruce in giving judgment, said this was an information against the defendant for selling, to the prejudice of the purchaser, an article of food which was not of the nature, substance, and quality of the article demanded by the purchaser. In this case the article demanded by the purchaser was 1lb. of shilling butter. The article sold was 1lb. of something which, on analysis, turned out to be: Moisture 9·37, curd 3·06, salt 3·55, and fat 84·02. Of the fat at least 90 per cent. was foreign fat—not butter at all. If any real butter entered into the composition of the mixture it must have been infinitesimal in quantity. The defendant did not, in fact, pretend that the mixture thus sold was butter, but he sought to protect himself from the operation of the statute by the fact, which was admitted by the prosecution, that the shopman by whom the sale was effected handed the mixture to the purchaser, who could not read, in a paper upon which were endorsed in legible printed characters the words, "Extra superfine butterine," and by the alleged fact, which, however, was disputed by the prosecution, and as to which he (Mr. Bruce) found for the prosecution, that on the purchaser asking for shilling butter, the seller said, "Do you want the shilling butterine?" He (Mr. Bruce) had reserved his judgment in order that he might consider whether the defendant was protected by 38 and 39 Vict., chap. 63. He was of opinion that the mere words "Extra superfine butterine" on the paper did not amount to a notice to the effect that the same was mixed, but as the defendant had merely substituted the word "butterine" for "butter," it would not necessarily convey to the mind of the purchaser the fact that the article was a mixture of butter and something else, or a mixture in which the something else was everything and the butter nothing. There was nothing on the label necessarily to convey to the mind of the purchaser the idea that he was buying anything but pure butter with a finer name. The Town Clerk said he understood that the defendant had filed a petition. The defendant was fined £5 including costs.

Adulterated Cayenne Pepper:—

At the Sheffield Town Hall, a grocer was charged with selling cayenne pepper which was certified by Mr. A. H. Allen to contain 6 per cent. of red lead. The defendant pleaded ignorance of the fact, and said he had had the pepper in stock for upwards of ten years. He was fined 5s. and costs

At the Birkenhead Borough Police Court, lately, before Mr. Samuell, the adjourned summons against James Stewart, of 3, Claughton Road, milk seller, for selling skimmed milk, came on for hearing. Mr. Waln prosecuted on behalf of the local authorities, and Mr. Spence appeared for the defendant. At the previous hearing, Mr. Smith, inspector of milk, had proved the purchase of a pint of milk on the 27th May, and had put in a certificate from Dr. Vacher, the Borough Analyst, stating that the milk had been deprived of 15 per cent. of its cream. Mr. Moore, who appeared for the defence on the previous occasion, had produced a certificate from Dr. Campbell Brown, Public Analyst for Lancashire and Liverpool, relative to the quality of the milk, but this had been ruled to be inadmissible, unless *Dr. Brown was present.* Dr. Campbell Brown was now in court. Mr. Spence

urged a number of minute technical objections, all of which were overruled, except one as to the inadequacy of the certificate. With regard to this the magistrate expressed his opinion that the certificate was all that the act required; but, as it might be desirable to have more information as to the constituents of the milk, he was willing to adjourn the case in order that it might be more fully set out. Dr. Vacher said he had his laboratory book in court, and was quite prepared to give any particulars. Having been sworn, he stated in answer to Mr. Spence that in analysing the milk he first weighed out 10 cubic centimetres of milk, which weighed 10·829 grammes. In ascertaining the proportion of solids, instead of totting up to 100, he totted up to 102·9, a very usual mode, and then the constituents came out:—Water, 90·21; Fat, 1·70; Solids, not fats, 10·99; total, 102·90. The ash was 0·70. The result of the analysis was to show that 15 per cent. of fat had been abstracted from the milk. The standard amount of fat that he required was 2·00 but the sample showed but 1·7. He had analysed milk in which the fats were as high as 6·08, but if the sample had come up to 2·00 he should not have certified against it. Mr. Spencer asked Dr. Vacher what was his experience as an analyst, and if he had not been unsuccessful in three or four examinations; but Mr. Samuell said he could not go into that, and it was not a proper question to ask. He was satisfied that the Corporation of Birkenhead had appointed a fit and proper person to be the Analyst of the Borough, and he was not the person to examine Dr. Vacher as to his qualifications. He might as well ask Mr. Spence if he knew more law than Mr. Waln, or *vice versa*. Dr. Vacher said it was not the fact. He was never plucked at any examination. Dr. Campbell Brown, was then called and stated that on the 4th of June he received a bottle of milk from Mr. J. Stewart, who was accompanied by another farmer. The bottle was sealed with a red seal marked "C.I.N. Borough of Birkenhead." The seal was intact and had not been tampered with. He produced the bottle. When he received it the seal was in better condition than that of the third, and as yet untouched, sample produced by the Inspector. Mr. Samuell said it appeared a very insecure method of sealing the articles. He could draw the cork of the third sample without injuring the seal. Dr. Vacher, who was examining the empty bottle produced by Dr. Brown, said it appeared to have previously contained sweet oil, which would add to the quantity of fatty ingredients in the milk. Chief Inspector Smith said the bottle was clean when he filled it. He believed it previously contained spirits. Dr. Brown said it was butter and not oil that was in the bottle. He analysed the milk. He found lumps of butter floating about in it, caused by the churning it had received in its journey, sufficient to show that it must originally have been a rich milk. Having taken out the lumps of butter he ascertained the quantity of fat in them, and found it of itself to be more than Dr. Vacher had extracted from the whole of the milk. Then he analysed the milk that remained and found an additional quantity of fat which had not been converted into butter, and that, added to the butter found floating, made a total of 2·83 per cent. of fat, a standard somewhat above the average of good Cheshire milk. He did not at all find fault with Dr. Vacher's standard, it was rather lower than his own; therefore it was merely a question whether Dr. Vacher got the whole of the fat out of his sample of milk. There was internal evidence quite sufficient to show that Dr. Vacher failed to get the whole of the fat out. The proof of that was that he found 10·99 solids not fat. That was almost the total solids found in ordinary pure milk as it came from the cow with the fat still in it. Whenever he got a result like that from an analysis he knew that he had failed to get the whole of the fat from the preparation, and he did the analysis again. It was an exceedingly rare thing to get anything like 10·9 solids not fat; 9·2 or 9·3 were much more common. Deducting 9·3 from 10·9 left a difference of 1·6, and this was probably the quantity of fat that Dr. Vacher failed to extract. Mr. Samuell: Then your contention is this: that a portion of the solids which Dr. Vacher classed as solids not fats ought to have been a portion of fat? Dr. Campbell Brown said there was no doubt about it in his mind, from Dr. Vacher's own analysis, and that allowance would make it correspond with his, or, in fact, show the milk to be somewhat richer. That would be accounted for by the fact that when he analysed the milk it was a fortnight old, and the solids, not fats, had decreased by decomposition. Dr. Vacher said he could not think with Dr. Brown that the solids not fats never reached beyond the point of 9·2 or 9·3. Dr. Brown said it was extremely rare for them to be beyond 9·5. The standard adopted by the Society of Public Analysts was 9·0. Dr. Vacher quoted a work by Dr. Wanklyn, but Dr. Brown said Wanklyn was not worth anything for judicial purposes, because he put forward a number of analyses of milks at much higher standard than were commonly met with. If Dr. Vacher would become a member of the Society of Public Analysts, he would be aware that the matter had been very fully discussed by them, and that they had fixed on a standard of 2·20 for fats, and 9·00 for solids not fats. Dr. Vacher, by working up his standard, would in two cases out of ten prosecute for the *addition of water where no* water had been added. He (Dr. Brown) had done over 9,000 milk analyses

up to the present, and something like two out of ten would have been below the mark if the standard of solids not fats was put as high as 9·60. Dr. Vacher asked Dr. Brown whether, the two samples being analysed, one in a fresh, the other in a sour condition, the results obtained by the analyst who analysed the fresh would not, *ceteris paribus*, be more likely to be correct than those of the analyst who analysed the sour. Dr. Brown replied that the answer to that was that there was a regular diminution of the solids not fats owing to the decomposition of the milk, and allowance was therefore made corresponding to the age of the milk. Mr. Samuell said this was a very interesting discussion, and he would sit and listen to it with a great deal of pleasure, but he did not think it would aid him in forming his judgment in the case, because where two gentlemen disagreed so markedly as in this case as a matter of course nothing remained for him but to dismiss it. Summons dismissed with costs.

At Bath, William B. Beauchamp, 6, Abbey Church Yard, was summoned for having on the 30th May sold to H. G. Montagu, an inspector under the Sale of Food and Drugs Act, one pint of milk, which was not of the nature, quality, and substance demanded. Mr. Moger prosecuted on behalf of the Sanitary Committee, and Mr. A. R. Poole, defended. Inspector Montagu deposed that on the 30th May last he visited No. 6, Abbey Church Yard, of which the defendant is the registered owner. He asked the female in the shop for a pint of new milk. She served him, and he told her he had purchased it for the purpose of being analysed by the Public Analyst, and asked her if she would have it divided into three parts. She said she would, and he accordingly divided it and put the milk into three separate bottles, which were sealed. He retained one bottle of the milk himself which he produced. He received the certificate from the Public Analyst in due course. He gave the ordinary price for the milk. He took six samples of milk that day, or which he gave the same price with one exception. By Mr. Poole: He had no regular time of calling on the dairymen. He had called at the defendant's shop before. He usually called on the dairymen about once a month. He did not pay particular attention to any one establishment. The milk he was served with was taken from a metal vessel on the counter. It was not taken from a pan behind the counter. He could not say whether the milk had been standing in the shop all day. He was supplied with the milk as new milk. By Lieut.-Colonel Ford: The shop-woman did not say that the new milk had not arrived. Mr. J. W. Gatehouse, City Analyst, was called and examined at some length by Mr. Poole for the purpose of showing that the feeding of cows and the differences in the animals themselves together with the season of the year made a difference in the quality of the milk. His standard of milk was 2·2 of fat but the average should not really be lower than 2·5. In this case he only found 1·48 of fat. He did not know whether that standard was higher than that at Bristol. If the greater portion of the milk had been sold in the morning and had then remained standing without being disturbed, there would have been a considerable formation of cream at the top of the milk. By agitation the cream would return and mix with the milk. It was possible that in the ordinary mode of dipping the first customers would get the richest milk. Continuing his evidence, Mr. Gatehouse said the quality was no better than skimmed milk. Mr. Pool addressed the Bench for the defence, and criticised the evidence given by the analyst and said he should call evidence to prove that the milk had not been tampered with in any way whatever. It was treated in the way in which milk is ordinarily treated, and if the earlier customers got milk of a rather better quality than the others it was not done with a fraudulent intent of any kind. In a case like this he contended that it was never intended any penalty should be inflicted by the legislature. Referring to the hour the inspector called for the milk, he said it was just at the time when the morning's milk would be in its poorest state, and it was, he urged, unfair of the inspector to call at that time of the day. Emanuel Green, farm bailiff to defendant, was called and deposed that all the milk was taken direct from the cows and sent in locked tins by rail to Bath. Witness saw the cows milked. As a matter of fact the first customers would get the best milk. Emily Candy deposed to having received the milk in question from which the inspector was served. The milk was served out of the trunk to customers, and was never tampered with in any way. At the time the inspector called there were about 3 or 4 gallons left. She had been accustomed to serve milk, and knew it to be a fact that milk at the bottom was poorer than at the top. This could not be avoided. If the cream were stirred it would float on the top but would not return to the milk. Mr. Lewis Vigis, chemist, 24, Monmouth Street, Bath, said from time to time he had examined defendant's milk. His opinion was that the milk became poorer as it was served out. After a short deliberation the Bench dismissed the case.

Important:—

Recently a special case was stated by the Magistrate of the Thames Police Court at the request of W. T. Harrison, one of the sanitary inspectors of Poplar, to the effect that he, the magistrate, had

dismissed a complaint by the inspector against Henry Richards, a milk vendor, that the latter had sold milk adulterated with 20 per cent. of water (in support of which complaint the certificate of the Public Analyst for Poplar to the effect that the said milk was so adulterated was produced), on the ground that he, the magistrate, was of opinion that the said milk might have been a sample of very poor but genuine milk, from which some of the original richness had been abstracted by ladling out for sale, and that though he received the certificate of the said analyst as evidence of the constituents of the said milk, he was of opinion that it was for him and not the analyst to decide as to the fact of adulteration. After argument before the Queen's Bench Division of the High Court, the Judges remitted the case back to the magistrate with their opinion that his judgment was erroneous.

We quote the following from the *British Medical Journal* of the 23rd July. We cannot at all agree with the comments made, and if 30 per cent. of water in butter milk is not "flagrant adulteration" we should very much like to know what is.

PROSECUTION UNDER THE SALE OF FOOD AND DRUGS ACT.

There has just been given a decision of some importance in reference to the above Act. A farmer was recently convicted in Lancashire for selling butter-milk which, on analysis, was found to contain 30 per cent. of water; it being contended by the official analyst that 20 per cent. was a sufficient quantity of water to use in the process of churning. Evidence was brought for the defence to show that there could be no uniform percentage, as it depended on the temperature, sometimes as much as 50 per cent. of water being necessary. Notwithstanding, a conviction was obtained. An appeal was made, and the judges at once unanimously reversed the decision given in the lower court; and we cordially agree with their remarks, that the case was one which should never have been undertaken by the authorities. These latter should bear in mind that an Act such as the Sale of Food and Drugs is to put down flagrant adulteration, and not to be used as an agent for harassing different opinions on slender and insufficient grounds.

RECENT CHEMICAL PATENTS.

The following specifications have been recently published, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

No. 1880	Name of Patentee.	Title of Patent.	Price.
4865	F. M. Lyte	Manufacture of Sugar	2d.
4932	F. M. Lyte	Treatment of Ores or Metallic Mixtures	4d.
4900	H. W. Parrott	Treating Night Soil for Manufacture of Manure	2d.
4908	H. G. Grant	Manufacture of Ammoniacal Salts	2d.
4933	J. W. Swann	Electric Lamps	6d.
4985	T. Morgan	Manufacture of Soda	6d.
5287	B. E. R. Newlands	Manufacture of Sulphate of Alumina	4d.
3471	W. Chadwick and J. Kynaston	Separating Ferrocyanides of Iron from Liquids containing the same	4d.
4869	J. Hargreaves	Manufacture of Sulphates of Soda and Potassa	6d.
4987	C. D. Abel	Manufacture of Compounds of Sugar and Lime from Molasses, &c.	2d.
5030	W. R. Lake	Manufacture of Manure	2d.
5033	J. H. Johnson	Electric Lamps	2d.
5037	E. Parnell and A. French	Obtaining Sulphate and Oxide of Zinc from Cupreous Ores	2d.
5066	M. De la Vega	Manufacture of Sugar	4d.
5231	H. Stokes	Manufacture of Sugar	6d.
5332	J. Eckart	Preserving Meat	4d.

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; Journal of Applied Science; The Boston Journal of Chemistry; The Provisioner; The Practitioner; New Remedies; Proceedings of the American Chemical Society; Le Practicien; The Inventors' Record; New York Public Health; The Scientific American; Society of Arts Journal; Sanitary Engineer of New York; The Cowkeeper and Dairyman's Journal; The Chemists' Journal; Oil and Drug News; The Textile Record of America; Sugar Cane; Country Brewers' Gazette; The Medical Record; Oil and Drug Journal; Analysis of *Simpler Salts, by H. A.* Phillips; Report of The People *v.* Schrumpf, New York.

THE ANALYST.

SEPTEMBER, 1881.

THE NEW YORK ADULTERATION ACT.

We have pleasure in drawing attention to the reprint of the Adulteration Act for the State of New York published in our present number. It is, in our opinion, without doubt the most complete and perfect anti-adulteration Act that has yet been passed in any country. The advantages which it possesses over our own English Act are evident. A definition of adulteration, both as regards food and drugs, is contained in the Act itself, and that definition is such that it would be impossible, as far as we can see, to raise the foolish quibbles which from time to time have been raised in the administration of the English Sale of Food and Drugs Act.

The New York law also contains a special proviso by which it would not only be possible, but the duty of the State board of health to procure and publish from time to time a list of articles, mixtures, or compounds, which are exempted from the provisions of the Act.

The penalties to be imposed are moderate but decisive, and from the way in which the board of health are going to work at the present time, and judging from the reports in the *Sanitary Engineer*, which has been the leading paper in New York in carrying the matter so far through, we think there is no doubt that within a few months the Adulteration Act will be working in the State of New York in a more satisfactory manner than our own is, even after several years of friction and worry over technical grounds which have been raised by acute solicitors simply with the view of enabling those who really have been guilty of offences under the Act to escape from its penal consequences.

ON THE FIGURES OR PATTERNS WHICH DROPS OF VARIOUS FATS ASSUME UNDER CERTAIN CONDITIONS.

By A. Wynter Blyth, M.R.C.S.

Read before the Society of Public Analysts, on 27th June, 1881. *(Illustrated.)*

I know of no notice of the curious patterns which may be obtained by simply melting any fat and dropping it in the fluid state, on to water or on to smooth wet surfaces.

The general method is to melt the fat and then to drop it from a small glass rod held a few inches above the surface of water or moistened glass. Immediately the drop touches the water it solidifies in a definite form.

To attain success it is necessary that the fat as well as the water should be of a certain temperature, but with many of the glycerides and mixtures of glycerides, such for example as butter, butterine, dripping, &c., the range is very wide, so that if the fat is perfectly fluid and not above 100° C, and the water ranges from 0° to 15°, a pattern more or less perfect is obtainable.

Each fat appears to have its own distinctive pattern and can be identified by its pattern alone. On the other hand each fat has a variety of patterns, for every alteration of the experimental conditions modifies more or less the form of the congealed drops. If, however, the conditions under which each experiment is performed are precisely similar, then there is no difficulty in obtaining the same form or at least very similar forms any number of times.

The chief modifying conditions are the difference of temperature between the fluid fat and the water and the height from which the fat falls. I have found that from three to four inches is the best height, and that a greater fall than this tends to spread the films out and renders all patterns more or less similar.

Referring to individual forms—

Butter.—The experiments were made on several samples of genuine butter, as proved by analysis. The fat was melted and filtered and kept in an air bath at temperatures of from 40° to 80°, and then dropped from a clean warm glass rod on to water of from 10° to 15°. The most common and distinctive form obtained in this way was that of a beautiful foliated film not unlike the leaf of a pelargonium. Figs. 6 and 7 are accurate representations of the outline of these films, for they have been obtained by a process by which I have been enabled to transfer the film direct to the lithographic stone and thus have a direct impression. The details of delicate veining are, as might be expected, lost. The best pattern temperature for butter is 55°, the water being at 10°; but regular forms may be obtained up to 100°. At higher temperatures success is rare. I found that although butter of 40° to 50° when dropped on to water of 10° sets in a radiated star form, yet when dropped on to water of 8°, although momentarily there was a beautiful complicated foliation with many radiating wings, these wings suddenly mutually repelled each other, and the pattern fell or rather flew to pieces. Glass plates were prepared chemically clean by first treating with alcoholic soda and then washing with ether; the plate was then dipped into water and thus a thin water film obtained. On this perfectly smooth wet surface, butter and other fats were dropped. In the case of butter, the pattern lost much of its beauty, but was always very regular in outline. Figs. 1, 3 and 5 represent butter patterns on glass, and Fig. 2 an imperfect pattern on water. This is a very common form when the fat is not quite hot enough. In this case it was but three degrees above its melting point. Butter films are of extreme tenuity, and although several attempts to photograph them were made the light passed through almost as perfectly as through glass, therefore the photographic shadows were too indistinct to make any use of.

Butterine.—The various mixtures of animal fats in the market known as butterine or artificial butter give by no means identical patterns for they vary much in composition, but in each case the form can be distinguished from the butter films, and from the pattern alone it is always possible and often very easy to say whether a given film is butter or not. The best method to distinguish the artificial from the genuine product, is to take pure butter fat and the suspected sample and after melting them each at the same temperature to drop them on to the same glass plate side by side. Fig. 1 and Fig. 4 are patterns of pure butter and butterine treated in the manner suggested. The latter is full of minute crystals and is decidedly different in outline. All *butterines* examined have been found to possess this crystalline peculiarity. The

Supplement to "THE ANALYST," September, 1881.

ILLUSTRATING MR WYNTER BLYTH'S PAPER ON PATTERNS OF FATS.

Fig 1.

Fig. 2.

Fig 3.

Fig 4.

Fig 5

Fig 6.

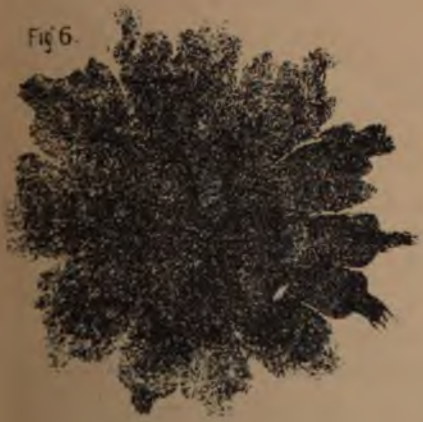

Fig 7.

Fig 8

Fig 9

Fig. 10.

pattern of one sample of butterine was found to be identical with that of tallow—little white dots containing bunches of crystals.

Tallow.—One form of tallow pattern has just been alluded to. It is the most common form when melted tallow falls on to water. This fat of high melting point is a good illustration of the many forms which may be produced at different temperatures. Thus at 32° the fat sets on to water in circular indistinct drops, but when more fluid and dropped on to glass its pattern is distinctive and crystalline.

Paraffin, giving no pattern by itself, when mixed with other animal fats as may be expected, profoundly modifies the film. Fig. 8 represents the pattern obtained by suitable treatment when equal parts of the hydrocarbon and stearic acid are mixed. The various figures which mixtures of different fats may be made to assume are represented in the accompanying photographs and drawings, and need no further description. With reference, however, to the fat-patterns of spermaceti, stearic acid, and generally fats of high melting points, it need scarcely be said that it is impossible to obtain them by dropping the fat on to cold water. Such a proceeding only gives a shapeless mass. To be successful it is absolutely essential that the water of the glass plate should be warm. For example, spermaceti gives no definite form when melted at 100°, and dropped on to cold water or even water of 50° the water must be heated up to 80° or 90° for a good result to be obtained. Very beautiful lace patterns are produced by wetting a warm glass plate with absolute alcohol and dropping tallow, stearic acid or spermaceti upon it; all the finer portions of the film are at once dissolved, while the veins and denser portions remain, reminding one of skeleton leaves (Figs. 9 and 10); the thin films of butterine, dripping and the like, will not stand this treatment, but are at once dissolved.

Cohesion Figures.—Tomlinson (*Phil. Mag.*, 1861 and 1862) some years ago drew attention to the peculiar cohesion figures of various liquids and oils, but the patterns of the solid fats when melted and dropped on to warm water do not appear to have received any consideration. I find, however, that each solid fat behaves differently, and may also in this way be identified and any admixture generally be correctly surmised. Should the water be at such a temperature as to keep the fat very fluid it rapidly spreads over the surface of the water, breaks up into lacunae, shows a beautiful iridescence, and the phenomena is over so rapidly as to leave but little impression on the memory. I therefore prefer to operate at temperatures just sufficient to keep the fat a little fluid so that the action takes place in a slow regular and methodical manner. As an example, one experiment may be detailed. Filtered pure butter fat, butter adulterated with 5 and with 10 per cent. of lard, and lard itself, were all put in the same air bath and brought to 55·5°. A large flat dish made chemically clean was filled with water of 44°, and a single drop of each of the four fats was dropped simultaneously on to the surface of the water and their behaviour noted. The butter drop immediately spread itself out into a thin film, became agitated by a rapid circular motion, and threw off minute droplets of butter fat. The motion gradually ceased, the drop extended itself, became irregular in outline, crenated at the edges and then contraction took place. At this stage its appearance was that of an irregular square, surrounded by small circles at distances from the central square and from each other of some three diameters. Both butter drops containing 5 and 10 per cent. of lard respectively, flattened out with extreme slowness, were agitated by a gyratory motion,

threw off no droplets of fat, and ultimately broke up with extreme slowness. It was noticed that the 5 per cent. drop was thinner and larger than the 10 per cent. The drop of lard underwent no alteration, remaining circular and quiescent up to the moment of solidification. It is obvious that this method is capable of great extension and may be found of practical value.

In reply to questions Mr. Blyth said that in no case did a mutton fat give a pattern like butter, and some of the mutton fats were heated and melted 30 or 40 times and kept for a long time—some more than a fortnight—above the melting point of mutton fat. In no case, however, could he have mistaken it for butter, and besides that there was always a film that could be photographed, but the fine butter films could not be; a sort of shadow might be obtained but no photograph, as was the case with animal fats. As to the vessel being chemically clean, he had thought at first that it should be so, and he took a lot of trouble for that purpose, but he found that was unnecessary; all that was wanted was the still surface of water. Ordinary vibration from traffic would not make any difference unless it caused a ripple.

ON A NEW BURNER FOR GRIFFIN'S GAS MUFFLE FURNACE.

By W. F. K. Stock, F.C.S., F.I.C.

Read before the Society of Public Analysts, on 27th June, 1881.

After a year's experience of the working of Griffin's Gas Muffle Furnace for ignitions at a high temperature, I can only express myself as very well satisfied with its convenience, compactness and cleanliness. As an apparatus for general purposes, however, it has serious faults. In my hands the chief of these have been the impossibility of controlling the temperature sufficiently to allow of the safe incineration of organic substances—of which milk residues may serve as a type, and the rapid corrosion of the metal tubes of the burner, when both air and gas were checked to furnish less heat.

Being anxious to remedy these defects, I made many efforts to construct a clay burner, which could be used for any desired temperature, and after numerous failures I succeeded in producing one which will, at pleasure, give a heat sufficient for the combustion of the hardest gas carbon, or for the safe incineration of milk residues, or other matters liable to injury from fusion, or volatilization of constituents. I may here say that I offered the burner to Mr. Charles Griffin for a consideration; but, whilst speaking favourably of it, he declined it because it would not give heat sufficient for the melting of cast iron in crucibles in the muffle. I, of course, only intended the burner for the use of analysts, and as an analyst, I have used a muffle almost daily for nearly seventeen years without even once having had occasion to melt cast iron in it. I felt also that the new army of Food Analysts wanted a burner which should be certain in its operation at any temperature between faint red and bright red, and I was determined that the power I had acquired in my new burner should not be lost to Public Analysts.

Unaided by woodcuts I can best describe the new burner by saying that it is simply a circular plate of fire-clay, exactly seven-eighths of an inch in thickness, pierced with twenty-seven holes a quarter of an inch in diameter. The lower part of this clay-plate falls into and fits closely the seating provided for Griffin's metal burner, and the upper part of it stands half an inch or so out of the seating, and is made exactly of the diameter of the

hole in the sole plate of the furnace; and round this upper part, which is somewhat less than the circumference of the seating, is placed a narrow iron hoop so as to bind the whole well together. When fixed for use the clay burner rests on a disc of wire gauze of sixteen meshes to the linear inch, and when intended for low temperatures the air supply is checked by sliding on to the foot of the air-tube of the burner a short bit of telescope tubing carrying a diaphragm. Thus modified, Griffin's Muffle Furnace will do anything a muffle furnace ever ought to do. I have myself used it within half an hour for the assay of ash in hard Durham coke, and the assay of ash in tea. For incineration of milk residues it is perfect; and a few moments suffice to raise the temperature from that point to a degree perfectly ample for the conversion of calcium carbonate to oxide. In conclusion, it may be well for me to add a few words as to the fixing of the burner and as to supply of gas. When in its place the face of the burner must not approach within three-sixteenths of an inch off the lower surface of the sole-plate of the furnace. The existence of this space is necessary to the proper supply of air. The gas must not, on any account, burn up the chimney as in the old burner. All gas burnt thus is wasted. In lighting the gas a neat method of procedure is the following:—Move back the chimney, close hole in top plate with a flat tile, put the tube, with diaphragm, on to the foot of the air tube; close the diaphragm, turn on the gas and apply a light to the edge of the clay-burner. The gas lights up quietly. The tile is removed from the top, chimney replaced, and the diaphragm opened, leaving the furnace in full operation. It is scarcely necessary to say that the muffle stoppers must be taken out, and the muffle left open during the lighting.

This paper is in no way intended as an advertisement. There are only two of the burners in existence, so far as I know. One is working on my muffle furnace, and the other I have deposited with Mr. Wigner. The latter burner has been knocked about a good deal, having made the journey to London thrice, and been worked on my furnace for a week, and then tried on Mr. Griffin's. Both burners were made in a tin mould in the laboratory. The one with Mr. Wigner has the holes made too large for very low temperatures.* The clay is a mixture of one part pounded and sifted firebrick, and two parts pipe-clay. The burner needs no firing before use. After gentle but perfect drying it may be carefully ground down to its place, and then the fire-clay dust forms a gas-tight lute.

To sum up: The advantages of the new burner are these, viz.:—

1st. Perfect control over the temperature.

2nd. Ready adjustibility of the temperature.

3rd. Low cost (exclusive of time, fifty could be had for ten shillings).

4th. Indestructibility.

5th. Economy of Gas, thirty-four feet per hour being sufficient for a bright red heat.

6th. Non-liability of flame flashing back.

DATE COFFEE.—According to the reports of the recent meeting of the shareholders of the Date Coffee Company, on the 12th July, the Chairman stated that by the end of August the Company would be in a position to put out close upon 40 tons per week. It is possible that some proportion of this may be sold by retailers as coffee, or as an admixture of chicory and coffee. It will be desirable to examine samples carefully to see if this be the case.

* The holes in my burners were cut out with a brass cork borer, whilst the clay was still somewhat moist but firm. If the burner could be made in plumbago clay it would be much improved.

THE ESTIMATION OF QUININE IN QUININE WINE, TINCTURES, &c.

By A. Wynter Blyth, M.R.C.S.

Read before the Society of Public Analysts, on 27th June, 1881. (Illustrated).

Having had occasion to make several estimations of quinine in the quinine wines and tinctures of commerce, it became necessary in the absence of any definite information in the text books, to independently investigate the best methods of procedure.

The Formula.—I have found hitherto nothing but the seven hydrate in common use. I therefore think that when any article is sold with a label describing it as containing so much "quinine," that we are justified in considering the word "quinine" to signify sulphate of quinine, and that sulphate of quinine to have the formula $(C_{20}H_{24}N_2O_2)$ H_2SO_4 $7H_2O$. That is—

Quinine $C_{20}H_{24}N_2O_2H_2O$	76·4 per cent.
SO_3	9·8 ,,
7 H_2O	13·8 ,,

In an actual determination of the quinine, precipitated from a solution of pure sulphate of quinine, the precipitate dried at 100° equalled 76·5 per cent., and generally speaking the error seems to lie a little on the side of over-estimation. However that may be, quinine precipitated in small quantity by an alkali, and dried at the temperature of boiling water, may I think be fairly calculated into sulphate of quinine by multiplying its weight by the factor—1·3.

Mayer's Reagent.—Mayer's reagent, made by dissolving 13·456 grm. of mercuric chloride and 49·8 grm. of potassic iodide in a litre of water, gives a dense white precipitate with the feeblest trace of quinine. When operating on solutions of quinine sulphate in pure water, the assay can be made as expeditiously by suitable arrangements as any titration of an alkali by an acid with the usual indicators. To use the reagent I employed a very simple mechanism which I will call a filter tube (see Fig. 2). Take a glass or tube, enlarge its end funnel shape in the flame (A), cut the minute funnel off at A., cram it with glass wool, slip it on to the end of another tube by means of a close yet easy piece of rubber. By the aid of this filter tube you can suck up a clear drop of the liquid, and by placing this clear drop on a black plate the addition of a droplet of the reagent at once shows if the quinine has all separated or not. When, however, you add "Mayer" direct to the wines and the like, the precipitate instead of being flocculent and rapidly separating, is so excessively fine that however tightly you pack your filter tube it is difficult to get a really clear drop, and the process though still accurate becomes tedious, consuming much time.

Dissolving known Quantities of Quinine in Wine.—Accurate results were obtained to the second decimal place, and therefore with the exception of time it compares favourably with estimations by weight. Mayer recommends the concentration of the solution to be as 1 : 800, and under these circumstances he says that each c.c. is equal to ·0108 grm. of quinine. But my own experiments show that this is not to be depended upon, and it appears probable that the value varies according to the temperature of the solution. For the "Mayer" precipitates are generally very soluble in warm water, reappearing as the solution cools. I would therefore recommend each time that the standard solution of

quinine and the wine to be assayed be first brought to exactly the same temperature and the solution of quinine made so as to be of the same strength as the solution to be examined should be, and then the number of c.c. in each case required accurately found.

Scheibler's Reagent.—Known quantities of quinine were precipitated by "Scheibler." The precipitate separated by filtration and then shaken up with strong soda and ether in the tube to be described. Here absolutely accurate results were obtained, but it did not compare favourably in respect of time with the next process.

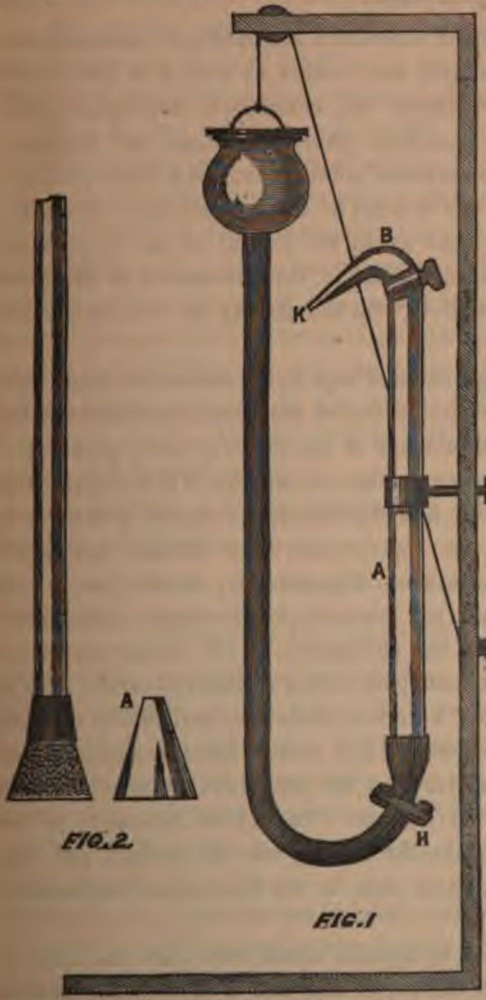

FIG. 2.

FIG. 1

Ether and Alkali Process.—In order to make the old-fashioned ether process expeditious and accurate I devised a new tube, which has since been found most useful and in fact indispensable for the separation quantitatively of volatile solvents when used for the recovery of substances from liquids. The tube A. (Fig. 1) may be of any convenient length or diameter to suit the analyst (ordinary burette size will do). It is furnished with a stopcock and bent beak B. of small, almost capillary bore. The lower end is attached to a long piece of pressure tubing, which is also connected with a small reservoir of mercury capable of being raised or lowered by a pulley. To use the apparatus raise the reservoir, after opening the stopcock, until mercury flows out of K. Now insert the point of the outlet tube K. into the liquid to be examined and by lowering the reservoir cause a vacuum so as to suck the liquid into the tube. The ether is introduced in exactly the same way. Now close the stopcock and run all the mercury or nearly all out of the tube and clamp the pressure tubing at H., and also shut the stopcock B. The tube and contents may be now violently shaken. After standing, the ether separates in a defined layer. The stopcock and clamp are now opened by raising the reservoir. The ether is made even to the last drop to flow out of K. into the tared flask from whence it is recovered by distillation.

Wines and tinctures freed from most of their spirit in this way were exhausted of quinine very rapidly by three times shaking up with ether, previously making the liquids strongly alkaline by soda. At first, a wooliness at the junction of the ether and the wine gave much trouble, but it was found that by using a large excess of soda the line between

the liquid and the ether became sharp and well defined. Quinine is practically quite insoluble in strong soda lye.

I therefore declare that this method in my experience is, all things considered, the best for quinine estimations, but the others may be used as confirmatory checks.

THE PRINCIPLES OF HOP-ANALYSIS.

By Dr. G. O. Cech.*

Hop flowers contain a great variety of different substances susceptible of extraction with ether, alcohol and water, and distinguishable from one another by tests of a more or less complex character. The substances are :—Ethereal oil, chlorophyll, hop-tannin, phlobaphen, a wax-like substance, the sulphate ammoniate, phosphate, citrate and malates of potash, arabine, a crystallized white and an amorphous brown resin, and a bitter principle. That the characteristic action of the hops is due to such of these constituents only as are of an organic nature is easy to understand; but up to the present we are in ignorance whether it is upon the oil, the wax, the resin, the tannin, the phlobaphen or the bitter principle individually, or upon them all collectively, that the effect of the hops in brewing depends.

It is the rule to judge the strength and goodness of hops by the amount of farina—the so-called lupuline; and as this contains the major portion of the active constituents of the hop, there is no doubt that approximately the amount of lupuline is a useful quantitative test. But here we are confronted by the question whether the lupuline is to be regarded as containing *all* that is of any value in the hops and the leaves, the organic principles in which pass undetected under such a test, as supererogatory for brewers' purposes? Practical experience negatives any such conclusion. Consequently, we are justified in assuming that the concurrent development and the presence of the several organic principles—the oil, the wax, the bitter, the tannin, the phlobaphen, in the choicer sorts—are subject, within certain limits, to variations depending on skilled culture and careful drying, and that the aggregate of these principles has a certain attainable maximum in the finer sorts, under the most favourable conditions of culture, and another lower maximum in less perfectly cultivated and wild sorts. The difference in the proportion of active organic substance in each sort must be determined by analysis. There then remains to be discovered which of the aforesaid substances plays the leading role in brewing, and also whether the presence of chlorophyll and inorganic salts in the hop-extract influences or alters the results?

That in brewing hops cannot be replaced by lupuline alone, even when the latter is employed in relatively large quantities, is well known, as also that a considerable portion of the bitter principle of the hop is found in the floral leaves. Neither can the lupuline be regarded as the only active beer agent, as both the hop-tannin and the hop-resin serve to precipitate the albuminous matter, and clarify and preserve the beer.

Both chemists and brewers would gladly welcome some method of testing hops, which should be expeditious, and afford reliable results in practical hands. To accomplish this account must be taken of all the active organic constituents of the hops, which can be

* "Zeitschrift fur Analyt. Chemie.," 1881.

extracted either with ether, alcohol, or water containing soda (for the conversion of the hop tannin in phlobaphen).* It should further be ascertained whether the chlorophyll percentage in the hop bells, new and old, is or is not the same in cultivated and in wild hops, and whether the aggregate percentages of organic constituent observe the same limits.

As wild hops nowadays are frequently introduced in brewing, the proportion of chlorophyll and organic and inorganic constituents in them should be compared with those of cultivated sorts, taking the best Bavarian or Bohemian hops as the standard of measurement. The chlorophyll is of minor importance, as it has little effect on the general results.

By a series of comparative analysis of cultivated and wild hops, in which I would lay especial stress on parity of conditions in regard of age and vegetation, the extreme limits of variation of which their active organic principles are susceptible could be determined.

There is every reason to suppose that the chlorophyll and inorganic constituents do not differ materially in the most widely different sorts of hops. The more important differences lie in the proportions of hop resin and tannin. When this is decided, the proportion of tannin or phlobaphen in the hop extract or the beer can be determined by analysis in the ordinary way. But whenever some quick and sure hop test shall have been found, *appearance and aroma* will still be most important factors in any estimate of the value of hops. Here a question arises as to whether hops from a warm or even a steppe climate, like that of South Russia, contain the same proportion of ethereal oil—that is, of aroma—as those from a cooler climate, like Bavaria and Bohemia, or, like certain other fruit species of southern growth, they are early in maturing, prolific, large in size, and abounding in farina, but *deficient in aroma.*

The bearings of certain experimental data on this point I reserve for consideration upon a future occasion.

ANALYSIS OF FOOD AND DRUGS IN NEW YORK.

The Sanitary Committee of the New York State Board of Health, at a recent meeting in this city, discussed chapter 407 of the Laws of 1881, entitled "An Act to prevent the adulteration of food and drugs." The articles which come under the provisions of the Act were divided into eleven groups, each group being assigned to an Analyst, as follows :—

Group No. 1—Fruit and Spices ; Dr. Lattimore, of Rochester.

Group No. 2—Sugar, glucose, syrups, molasses, confections, honey, soda-water, ice-cream ; Dr. Pitt, of Buffalo.

Group No. 3—Butter, cheese, lard oil, olive oil ; Dr. Caldwell, of Ithaca.

Group No. 4—Wine, beer, spirits, cordials ; Dr. Englehart, of Syracuse.

Group No. 5—Tea, coffee and cocoa ; Drs. Lattimore and Hoffman.

Group No. 6—Organic chemicals as met with in Pharmacy, quinine, and its preparations, ether, food essences ; Dr. Caldwell.

Group No. 7—Meat extracts, fish and fish extracts, and gelatine ; Dr. Chester, of Hamilton.

Group No. 8—Vegetable and animal drugs ; Dr. Hoffman.

Group No. 9—All pharmaceutical preparations ; Dr. Hoffman.

* See C. Etti. in "Dingler's Polytech. Journ.," 1878, p. 354.

Group No. 10—Cereals, grain products, artificial cereals for the use of children and invalids, baking powders, and all chemicals used by bakers; Dr. Love, of New York.

Group No. 11—Milk and its preparations; Prof. Chandler.

The following were appointed inspectors to collect samples for analysis; Dr. G. D. Smith, of Fulton county; Dr. A. L. Colby, of New York, and Dr. C. E. Munsel, of New York.

ADULTERATION ACT FOR NEW YORK.

The following is the text of the new law, which has just been passed by the State of New York Legislature:—

AN ACT to prevent the adulteration of food or drugs.

The People of the State of New York, represented in Senate and Assembly, do enact as follows:—

Section 1.—No person shall, within this State, manufacture, have, offer for sale, or sell any article of food or drugs which is adulterated within the meaning of this Act, and any person violating this provision shall be deemed guilty of a misdemeanour, and upon conviction thereof, shall be punished by fine not exceeding fifty dollars for the first offence, and not exceeding one hundred dollars for each subsequent offence.

Section 2.—The term "food," as used in this Act, shall include every article used for food or drink by man. The term "drug," as used in this Act, shall include all medicines for internal and external use.

Section 3.—An article shall be deemed to be adulterated within the meaning of this Act.

(*a.*)—In the case of drugs—

1. If when sold under or by a name recognized in the United States Pharmacopœia, it differs from the standard of strength, quality, or purity laid down therein.

2. If, when sold under or by a name not recognized in the United States Pharmacopœia, but which is found in some other Pharmacopœia or other standard work on Materia Medica, it differs materially from the standard of strength, quality, or purity laid down in such work.

3. If its strength or purity fall below the professed standard under which it is sold.

(*b.*) In the case of food or drink—

1. If any substance or substances has or have been mixed with it so as to reduce or lower or injuriously affect its quality or strength.

2. If any inferior or cheaper substance or substances have been substituted wholly or in part for the article.

3. If any valuable constituent of the article has been wholly or in part abstracted.

4. If it be an imitation of, or be sold under the name of, another article.

5. If it consists wholly or in part of a diseased or decomposed, or putrid or rotten, animal or vegetable substance, whether manufactured or not, or, in the case of milk, if it is the produce of a diseased animal.

6. If it be coloured, or coated, or polished, or powdered, whereby damage is concealed, or it is made to appear better than it really is, or of greater value.

7. If it contain any added poisonous ingredient, or any ingredient which may render such an article injurious the health of a person consuming it: Provided, that the State board of health may, with the approval of the governor, from time to time declare certain articles or preparations to be exempt from the provisions of this Act: And provided further, that the provisions of this Act shall not apply to mixtures or compounds recognized as ordinary articles of food, provided that the same are not injurious to health and that the articles are distinctly labelled as a mixture, stating the components of the mixture.

Section 4.—It shall be the duty of the State board of health to prepare and publish from time to time, lists of the articles, mixtures or compounds declared to be exempt from the provisions of this Act in accordance with the preceding section. The State board of health shall also from time to time fix the limits of variability permissible in any article of food or drug, or compound, the standard of which is not established by any national Pharmacopœia.

Section 5.—The State board of health shall take cognizance of the interests of the public health as it relates to the sale of food and drugs, and the adulteration of the same, and make all necessary investigations and inquiries relating thereto. It shall also have the supervision of the appointment of Public

Analysts and Chemists, and upon its recommendation, whenever it shall deem such officers incompetent, the appointment of any and every such officer shall be revoked and be held to be void and of no effect. Within thirty days after the passage of this Act, the State board of health shall meet and adopt such measures at may seem necessary to facilitate the enforcement of this Act, and prepare rules and regulations with regard to the proper methods of collecting and examining articles of food or drugs, and for the appointment of the necessary inspectors and analysts; and the State board of health shall be authorised to expend, in addition to all sums already appropriated for said board, an amount not exceeding ten thousand dollars for the purpose of carrying out the provisions of this Act. And the sum of ten thousand dollars is hereby appropriated out of the moneys in the treasury, not otherwise appropriated, for the purposes in this section provided.

Section 6.—Every person selling or offering or exposing any article of food or drugs for sale, or delivering any article to purchasers, shall be bound to serve or supply any Public Analyst or other agent of the State or local board of health appointed under this Act, who shall apply to him for that purpose, and on his tendering the value of the same, with a sample sufficient for the purpose of analysis of any article which is included in this Act, and which is in the possession of the person selling, under a penalty not exceeding fifty dollars for a first offence, and one hundred dollars for a second and subsequent offences.

Section 7.—Any violation of the provisions of this Act shall be treated and punished as a misdemeanour; and whoever shall impede, obstruct, hinder, or otherwise prevent any Analyst, Inspector, or prosecuting officer in the performance of his duty shall be guilty of a misdemeanour, and shall be liable to indictment and punishment therefore.

Section 8.—Any acts or parts of acts inconsistent with the provisions of this Act are hereby repealed.

Section 9.—All the regulations and declarations of the State board of health made under this Act, from time to time, and promulgated, shall be printed in the statutes at large.

Section 10.—This Act shall take effect at the expiration of ninety days after it shall become law.

BUTTER SUBSTITUTES.

Discussing the subject of dairy-farming, with special reference to the manufacture of adulterated products, an agricultural contemporary says:—Dr. Lyon Playfair's speech on this subject in the House of Commons, on April 1st this year, will not soon be forgotten. The gist of it was to the effect that if wholesome substitutes could be found for butter and cheese, at a lower cost than the real articles, the public would have no reason to complain, and British producers would have to protect themselves by making their products better and at a lower cost. He said: "If we could extract butter fats economically from vegetable oils, and give a sound, healthy butter from them at a cheap rate, it would be a matter of indifference to the public whether the butter came from the cow or from the vegetable." This view of the case may be theoretically correct, but practically it matters a great deal to the consumer whether he pays for butter substitutes at genuine butter price. Again, with regard to cheese, he says:—"Of the cheese principle in milk, there is only 4 lbs. to the 100 lbs. of milk, while in beans and peas there are 20 lbs. to the 100 lbs. Cheeses are made from peas in China, and are exposed for sale in the markets of that country, where they are esteemed by the people; but to our palates they are insipid, because they do not contain butter fats. I look forward to the day when cheeses will be made from beans, peas, and lentils, and after being mixed with good oleo-margarine, may form palatable and very economical cheeses." Oleo-margarine is beyond question a very wholesome and useful article of diet, when it is prepared from clean and sweet fats, and there can be no possible objection raised to its sale as oleo-margarine. But, as a matter of fact, it is sold only as an admixture with genuine butter, the admixture—whether of the highest or lowest grade—being invariably sold as butter. *This is the only fraudulent part of the business, and the only genuine cause of complaint which the British dairy farmer has with regard to the matter.* If consumers ask for butter made from cream, they should be able to obtain it, or if only an adulterated butter is obtainable, they ought to be informed of the real nature of the article they are purchasing. Dr. Playfair may have a theoretical liking for oleo-margarine butter and leguminous cheese, but he would probably have a very practical objection to purchase these articles as genuine dairy products at the full market price of the real articles. British dairying industry requires to be protected from fraud, and it would then have no cause to fear free trade in oleo-margarine or pulse cheese. A law should be passed which would render it impossible for butters which contain foreign admixture to be sold as genuine butters. There is at present no such law, for it is well known that some of the most

saleable butters in our large towns are foreign manufactures, containing a large proportion of oleo-margarine. British dairy farmers cannot contend against this sort of competition, because the adulterated article is of very superior "make," and is sold in a very handy and attractive form, with a large profit, at rates which are considerably lower than those for which the genuine article can be produced. The only legal protection which British dairying interests need is protection from fraud. At the present time Continental countries are importing oleo-margarine on a very large scale from the United States and even from London, and the well-made, attractively-packed butter from these same countries meets a sale which is practically driving all but the very best of genuine home products out of the market. This would be fair, if the competing terms were equal; but they are not equal, because all these foreign adulterated articles are sold as butter. If they were sold as admixtures, consumers could pay their money and take their choice; as it is, they pay their money for what seems to be the best. Possibly it may be the best, *ad valorem*, but there are many who would not purchase adulterated butter at any price if they knew it to be adulterated. The fraudulent sale of adulterated dairy products should be adequately prevented by legal enactment, and then the action of consumers would settle the trade on a firm and definite basis.

THE PUBLIC WATER SUPPLIES OF ENGLAND.

VALUATION, ACCORDING TO WIGNER'S VALUATION SCALE, OF THE ANALYSES PUBLISHED THIS MONTH.

In the following table we give the *average* valuation of the public water supplies from January to June, and the valuations for last month (the July waters) and this month (the August waters).

	Average to June.	July.	August.
LONDON—Kent	30	27	20
New River	26	17	17
East London	32	39	20
Southwark and Vauxhall	34	28	31
West Middlesex	30	24	29
Grand Junction	30	23	25
Lambeth	37	29	31
Chelsea	30	26	32
Bath	12	19	20
Birmingham	33	37	26
Bolton	..	17	19
Bradford	53	53	59
Brighton	24	23	25
Bristol	22	27	..
Bury	..	35	24
Cambridge	28	26	22
Canterbury	17	22	16
Coventry	33	..	..
Croydon	27	30	..
Darlington	33	39	96
Derby	18	13	..
Droitwich	39	..	..
Dublin	23	..	13
Dudley	45	..	..
Edinburgh	28	21	20
Exeter	20	16	23
Grantham	27	..	32
Hastings	..	20	25
Huddersfield	23	26	28
Hull	23	..	..
Ipswich	27	30	30
King's Lynn	94	110	48
Leamington	26	..	26

	Average to June.	July.	August.
Leeds	35	28	22
Leicester	42	24	26
Liverpool	36	29	41
Llandrindod	13	..	..
Maidstone Water Company	39	34	30
" Public Conduit	36	28	25
Manchester	22	17	29
Newark	39	46	41
Newcastle-on-Tyne	37	40	43
Northampton	44	..	..
Norwich	36	49	58
Nottingham	39	46	38
Oldham	23	..	..
Plymouth	29	..	..
Portsmouth	30	22	26
Reading	25	20	34
Rochdale	9	7	9
Rugby	41	..	..
Salford	18	14	21
Sevenoaks	20	..	..
Sheffield	22	..	..
Shrewsbury	23	..	17
Southampton	43	..	40
Stockport	17	..	..
Stourbridge	37	..	..
Stourport	37	..	..
Sunderland	25	27	..
Swansea	16	14	19
Warwick	34	34	..
Whitehaven	9	17	14
Wolverhampton	46	39	32
Worcester	55	..	..

Taking the Metropolitan waters we find that the average valuation of the eight supplies for August is about one less than that for July.

The Kent and East London each show an improvement; the New River remains the same as last month; and in five cases there is a slight increase in the figure, although in every case but one the August figure is below the average for the first six months of the year.

The most pure of the provincial supplies during August are: Rochdale with a value of 9; Dublin, 13; Whitehaven, 14; Canterbury, 16; Shrewsbury, 17; Bolton and Swansea, each 19; and Edinburgh and Bath, each 20—and in nearly all cases these figures show a slight improvement upon the July waters.

The following supplies also show an improvement on the July supplies, viz.:—Birmingham, Bury, Cambridge, King's Lynn, Leeds, Maidstone, Southampton, and Wolverhampton.

On the other hand, in the following towns, the valuation shows increased impurity, viz.:—Bath, Bradford, Bolton, Darlington, Exeter, Grantham, Hastings, Huddersfield, Ipswich, Liverpool, Manchester, Newark, Newcastle, Norwich, Reading, Swansea.

Errata.—In the corresponding paper to this in our last issue the average valuation of the Chelsea water for the first six months was, by a printer's error, inserted as 39 instead of 30.

ANALYSTS' REPORTS.

Dr. J. F. Hodges, analyst for Belfast, reports that during the past quarter 54 articles of food, &c., were examined by him, viz.:—32 samples of sweetmilk, 14 of buttermilk, and 3 of aerated waters. Of these three samples of sweetmilk and seven samples of buttermilk were found adulterated; and fines were inflicted during the quarter, amounting to £9 10s. 8d., for violations of the Act.

At Somerset Quarter Session, held at Taunton, the county analyst, Dr. H. J. Alford, reported that during the past quarter he had analysed 255 samples, all of which, except one from the general public, were brought by the police inspectors. The samples included 86 of butter, five of which were adulterated; but in no case was the adulteration such as to be be prejudicial to health. The Chairman (Mr. R. H. Paget, M.P.) said in some cases there had been a failure of justice, owing to the analyst's certificate not having been given in proper form, according to the statute, and by his directions the Clerk of the Peace had communicated with the analyst on the subject. The Chief Constable had issued a circular in consequence of the suggestion made at the last quarter session, calling the attention of the superintendents of the police to the large importation of oleo-margarine, butterine, and other compounds passed off as butter. Mr. Rogers asked if the report of the analyst stated what the butter was adulterated with. The Clerk of the Peace said foreign fat. The Chairman observed that foreign fat was invariably of an inferior quality, and care should be taken to protect the interests of the public.

Dr. Alfred Hill, analyst for the Borough of Birmingham, reports that during the past quarter he examined 43 samples, viz.:—15 of milk, 12 of tea, 6 of ale, 6 of flour, and 4 of butter. Nine of the milks had been tampered with, but the other samples were unadulterated. One milk had been deprived of 50 per cent. of its cream, and a fine of £10 and costs was inflicted on the vendor.

The Analysis of Public Water Supplies.—During the past month we have forwarded to the Analysts who are engaged in this scheme a copy of the Tables of Water Analysis, the Instructions for Water Analysis, and other matter connected with the subject. In deference to the wishes of those engaged in the analyses, we have, as our present stock is exhausted, decided to print at once a further supply for publication.

SOCIETY OF PUBLIC ANALYSTS.

Analyses of English Public Water Supplies in August, 1881. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Date when drawn.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine in Chlorides.	Phosphoric Acid in Phosphates.	Nitrogen in Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in		Hardness, Clark's Scale, in degrees.		Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
									15 mins. at 80° Fahr.	4 hours at 80° Fahr.	Before Boiling.	After Boiling.			
Kent Co.	Aug. 10	clear, green blue	none	1·35	trace	·350	none	·0022	none	none	15·0°	4·3°	24·80	few fibres	Wigner & Harland.
New River	,, 15	clear	none	1·17	trace	·137	·0007	·0006	·0030	·0210	13·7°	3·4°	18·48	satisfactory	B. Dyer.
East London ..	,, 4	yellow green	none	1·34	trace	·130	·0013	·0021	none	·0074	13·5°	3·0°	18·80	veg. debris fibres	Wigner & Harland.
Southwark & Vauxhall ..	,, 6	c. v. f. yellow	none	1·24	trace	·110	·0013	·0070	·0028	·0502	13·5°	4·0°	19·60	satisfactory	J. Muter.
'est Middlesex	,, 17	greenish yellow	none	1·17	none	·088	·0006	·0037	·0250	·0490	12·0°	2·4°	17·36	veg. debris & monads.	O. Hehner.
rand Junction	,,	pale yellow	none	1·06	trace	·092	·0002	·0059	·0012	·0631	12·3°	3·0°	17·80		A. Wynter-Blyth.
umbeth	,, 11	c. v. f. yellow	none	1·24	trace	·110	·0014	·0070	·0028	·0476	14·5°	4·0°	19·60	satisfactory	J. Muter.
helsea	,, 9	c. p. grn. yelw.	none	1·12	trace	·190	none	·0030	·0200	·0560	12·0°	3·0°	16·80		A. Dupré.
Bath	Aug. 10	c. f. blue	none	·96	none	·160	none	·0008	none	none	16·0°	4·0°	22·80	algæ & diatoms	J. W. Gatehouse.
Birmingham ..	,, 2	s. turb. grn. ylw.	none	1·47	traces	·169	·0020		·0050	·0490	10·8°	6·7°	18·24		A. Hill.
Bolton.........	,, 1	v. turbid	none	·47	none	·032	·0012	·0050	·0030	·0220	3·3°	3·3°	7·64	mineral mttr. & veg. deb.	W. H. Watson.
Bradford	,, 5	s. yelw. v. opqe.	none	·70	none	none	·0007	·0056	·0520	·2300	3·3°	3·0°	6·50	none	F. M. Rimmington.
Brighton.......	,, 9	c. blue green	none	1·84	trace	·318	·0034	·0049	none	none	12·0°	4·1°	21·00	vegetable debris	Wigner & Harland.
Bury (Lan.) ..	,, 9	s. yellow turbid	none	·55	none	·042	·0040	·0095	·0052	·0120	4·9°	4·6°	8·08	mineral mttr. & veg. deb.	W. H. Watson.
Cambridge	,, 15	c. pale blue	none	1·40	traces	·460	·0007	·0020	none	·0157	14·5°	8·5°	23·10	satisfactory	J. West-Knights.
Canterbury	,, 20	c. pale blue	none	1·47	none	·375	·0005	·0007	·0050	·0190	5·9°	4·1°	11·48	slight carb. of lime	S. Harvey.
Darlington	,, 15	c. brwnsh. yelw.	peaty	·50	trace	·002	trace	·0063	·0224	·3766	5·6°	5·3°	8·40	diatoms vegetable debris	W. F. K. Stock.
Dublin.........	July 30	almst. colourless	none	·82	trace	trace	·0005	·0040		·0400	1·2°	0·6°	3·56	diatoms, &c.	C. A. Cameron.
Edinburgh	Aug. 16	s. brown	none	·72	none	traces	·0016	·0072	·0128	·1024	5·2°	4·2°	5·60	none	J. Falconer King.
Exeter	,, 9	f. grnsh. yellow	none	·84	tracé	·201	·0023	·0028		·0579	2·9°	2·9°	7·00		F. P. Perkins.
Grantham	,, 10	grnsh. s. turbid	none	1·05	trace	·432	·0007	·0043	none	·0516	13·5°	3·5°	20·72	diatoms	A. Ashby.
Hastings	,, 10	slightly milky	none	4·70	trace	·120	none	·0040	none	·0020	6·5°	3·5°	20·30	none	H. Cheshire.
Huddersfield ..	,, 14	c. f. yelw. green	none	·55	none	·012	none	·0056	·0408	·0856	2·2°	2·0°	5·60	satisfactory	G. Jarmain.
Ipswich	,, 13	c. colourless	none	2·50	trace	·363	·0032	·0040	none	·0072	24·0°	4·8°	34·75	satisfactory	J. Napier.
King's Lynn ..	,, 8	yellow green	weedy	1·39	h. traces	·420	·0020	·0049	·0134	·0548	10·0°	3·5°	15·94	veg. debris diatoms moving organisms	W. Johnstone.
Leamington ..	,, 11	c. greenish	none	1·47	none	none	·0014	·0019	none	·0023	26·1°	19·8°	30·50	none	A. Bostock Hill.

SOCIETY OF PUBLIC ANALYSTS.

Analyses of English Public Water Supplies in August, 1881. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Date when drawn.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine in Chlorides.	Phosphoric Acid in Phosphates.	Nitrogen in Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in 15 mins. at 80° Fahr.	Oxygen, Absorbed in 4 hours at 80° Fahr.	Hardness, Clark's Scale, in degrees. Before Boiling.	Hardness, Clark's Scale, in degrees. After Boiling.	Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
Leeds	Aug. 12	light yellow	none	·62	none	none	none	·0028	·0084	·0515	3·4°	2·8°	4·48	peaty matter	T. Fairley.
Leicester......	,, 19	v. s. yellow	none	1·13	trace	·115	·0012	·0030	·0025	·0740	8·0°	4·7°	16·20	satisfactory	W. L. Emmerson.
Liverpool	,, 17	yellow green	s. peaty	1·06	traces	·067	·0021	·0070	·0560	·0920	4·8°	4·6°	9·10		A. Smetham.
Maidstone—															
Wtr. Company	,, 12	lgt. grn. s. opqe.	none	2·70	traces	·280	none	·0018	·0028	·0271	19·5°	7·2°	32·79	none	M. A. Adams.
Public Conduit	,, 12	c. light blue	none	2·30	traces	·350	none	·0007	·0028	·0109	18·6°	7·2°	33·32	none	M. A. Adams.
Manchester....	,, 12	c. colourless	none	·74	none	none	·0035	·0051	·0340	·1099	1·8°	1·8°	4·91	none	W. Thomson.
Newark	,, 9	bluish green	none	1·78	trace	·037	·0009	·0043	none	·0989	17·0°	8·5°	35·00	diatoms and desmids	A. Ashby.
Newcastle-on-Tyne......	,, 8	f. yellow	none	·76	trace	·044	·0010	·0110	·0060	·1300	11·8°	4·9°	15·40	satisfactory	J. Pattinson.
Norwich	,, 9	s. grnsh. yellow	none	2·20	traces	·059	traces	·0070	·0386	·0400	15·0°	5·0°	16·40	satisfactory	W. G. Crook.
Nottingham ..	,, 22	c. green. bluish	none	2·10	traces	1·250	none	·0005	none	·0100	15·0°	8·0°	29·80	veg. deb. & fibres animal.	Wigner & Harland.
Portsmouth ..	,, 14	clear	none	1·17	traces	·419	traces	·0021	none	none	11·5°	2·0°	18·70	decomp. veg. deb. diams.	W. J. Sykes.
Reading	,, 11	yellowish	none	1·00	trace	·144	·0014	·0063	·0040	·0560	14·8°	3·8°	21·75	vegetable debris	J. Shea.
Rochdale	,, 17	pale blue	none	·50	none	·010	·0030	·0036	none	·0005	2·5°	2·0°	4·20	satisfactory	T. A. Collinge.
Salford	,, 3	cloudy & yellow	none	·70	none	none	·0035	·0014	·0110	·0670	3·5°	3·0°	4·00	none	J. Carter Bell.
Shrewsbury ..	July 26	c. colourless	none	1·45		·300	·0010	·0015	none	none	22·0°	3·8°	26·00	none	T. P. Blunt.
Southampton..	Aug. 18	yellowish	none	·98	trace	·476	·0033	·0043	·0096	·0980	12·3°	4·5°	19·40	vegetable debris	A. Angell.
Swansea	,, 19	s. turbid	none	1·10	trace	none	·0010	·0063	·0040	·0040	3·0°	2·5°	4·90	earthy matter	W. Morgan.
Whitehaven ..	,, 4	v. s. turb. p. grn.	none	·36	none	·009	none	·0017	none	·0151	·4°	·4°	2·07	veg. deb. diams. desmids	A. Kitchin.
Wolverhampton	,, 13	s. yelw. tinge	none	1·29	trace	·065	none	·0042	·0013	·0448	13·7°	5·5°	21·42	veg. deb. spores diatoms	E. W. T. Jones.

Abbreviations:—c., clear; f., faint; h., heavy; p., pale; v. h., very heavy; v. s., very slight.

SOCIETY OF PUBLIC ANALYSTS.

Analyses of English Public Water Supplies in August, 1881. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Date when drawn.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine in Chlorides.	Phosphoric Acid in Phosphates.	Nitrogen in Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in		Hardness, Clark's Scale, in degrees.		Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
									15 mins. at 80° Fahr.	4 hours at 80° Fahr.	Before Boiling.	After Boiling.			
Kent Co.	Aug. 10	clear, green blue	none	1·35	trace	·350	none	·0022	none	none	15·0°	4·3°	24·80	few fibres	Wigner & Harland.
New River	" 15	clear	none	1·17	trace	·137	·0007	·0006	·0030	·0210	13·7°	3·4°	18·48	satisfactory	B. Dyer.
East London ..	" 4	yellow green	none	1·34	trace	·130	·0013	·0021	none	·0074	13·5°	3·0°	18·80	veg. debris fibres	Wigner & Harland.
Southwark & Vauxhall ..	" 6	c. v. f. yellow	none	1·24	trace	·110	·0013	·0070	·0028	·0502	13·5°	4·0°	19·60	satisfactory	J. Muter.
West Middlesex	" 17	greenish yellow	none	1·17	none	·088	·0006	·0037	·0250	·0490	12·0°	2·4°	17·36	veg. debris & monads.	O. Hehner.
Grand Junction	"	pale yellow	none	1·06	trace	·092	·0002	·0059	·0012	·0631	12·3°	3·0°	17·80		A. Wynter-Blyth.
Lambeth	" 11	c. v. f. yellow	none	1·24	trace	·110	·0014	·0070	·0028	·0476	14·5°	4·0°	19·60	satisfactory	J. Muter.
Chelsea	" 9	c. p. grn. yelw.	none	1·12	trace	·190	none	·0030	·0200	·0560	12·0°	3·0°	16·80		A. Dupré.
Bath	Aug. 10	c. f. blue	none	·96	none	·160	none	·0008	none	none	16·0°	4·0°	22·80	algæ & diatoms	J. W. Gatehouse.
Birmingham ..	" 2	s. turb. grn. ylw.	none	1·47	traces	·169	·0020		·0050	·0490	10·8°	6·7°	18·24		A. Hill.
Bolton........	" 1	v. turbid	none	·47	none	·032	·0012	·0050	·0030	·0220	3·3°	3·3°	7·64	mineral mttr. & veg. deb.	W. H. Watson.
Bradford	" 5	s. yelw. v. opqe.	none	·70	none	none	·0007	·0056	·0520	·2300	3·3°	3·0°	6·50	none	F. M. Rimmington.
Brighton......	" 9	c. blue green	none	1·84	trace	·318	·0034	·0049	none	none	12·0°	4·1°	21·00	vegetable debris	Wigner & Harland.
Bury (Lan.) ..	" 9	s. yellow turbid	none	·55	none	·042	·0040	·0095	·0052	·0120	4·9°	4·6°	8·08	mineral mttr. & veg. deb.	W. H. Watson.
Cambridge	" 15	c. pale blue	none	1·40	traces	·460	·0007	·0020	none	·0157	14·5°	8·5°	23·10	satisfactory	J. West-Knights.
Canterbury	" 20	c. pale blue	none	1·47	none	·375	·0005	·0007	·0050	·0190	5·9°	4·1°	11·48	slight carb. of lime	S. Harvey.
Darlington	" 15	c. brwnsh. yelw.	peaty	·50	trace	·002	trace	·0063	·0224	·3766	5·6°	5·3°	8·40	diatoms vegetable debris	W. F. K. Stock.
Dublin........	July 30	almst. colourless	none	·82	trace	trace	·0005	·0040		·0400	1·2°	0·6°	3·56	diatoms, &c.	C. A. Cameron.
Edinburgh	Aug. 16	s. brown	none	·72	none	traces	·0016	·0072	·0128	·1024	5·2°	4·2°	5·60	none	J. Falconer King.
Exeter	" 9	f. grnsh. yellow	none	·84	tracė	·201	·0023	·0028		·0579	2·9°	2·9°	7·00		F. P. Perkins.
Grantham	" 10	grnsh. s. turbid	none	1·05	trace	·432	·0007	·0043	none	·0516	13·5°	3·5°	20·72	diatoms	A. Ashby.
Hastings......	" 10	slightly milky	none	4·70	trace	·120	none	·0040	none	·0020	6·5°	3·5°	20·30	none	H. Cheshire.
Huddersfield ..	" 14	c. f. yelw. green	none	·55	none	·012	none	·0056	·0408	·0856	2·2°	2·0°	5·60	satisfactory	G. Jarmain.
Ipswich	" 13	c. colourless	none	2·50	trace	·363	·0032	·0040	none	·0072	24·0°	4·8°	34·75	satisfactory	J. Napier.
King's Lynn ..	" 8	yellow green	weedy	1·39	h. traces	·420	·0020	·0049	·0134	·0548	10·0°	3·5°	15·94	veg. debris diatoms moving organisms	W. Johnstone.
Leamington ..	" 11	c. greenish	none	1·47	none	none	·0014	·0049	none	·0023	26·1°	19·8°	30·59	none	A. Bostock Hill.

SOCIETY OF PUBLIC ANALYSTS.

Analyses of English Public Water Supplies in August, 1881. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Date when drawn.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine in Chlorides.	Phosphoric Acid in Phosphates.	Nitrogen in Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in		Hardness, Clark's Scale, in degrees.		Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
									15 mins. at 80° Fahr.	4 hours at 80° Fahr.	Before Boiling.	After Boiling.			
Leeds	Aug. 12	light yellow	none	·62	none	none	none	·0028	·0084	·0515	3·4°	2·8°	4·48	peaty matter	T. Fairley.
Leicester......	" 19	v. s. yellow	none	1·13	trace	·115	·0012	·0030	·0025	·0740	8·0°	4·7°	16·20	satisfactory	W. L. Emmerson.
Liverpool	" 17	yellow green	s. peaty	1·08	traces	·067	·0021	·0070	·0560	·0920	4·8°	4·6°	9·10		A. Smetham.
Maidstone—															
Wtr. Company	" 12	lgt. grn. s. opqe.	none	2·70	traces	·280	none	·0018	·0028	·0271	19·5°	7·2°	32·79	none	M. A. Adams.
Public Conduit	" 12	c. light blue	none	2·30	traces	·350	none	·0007	·0028	·0109	18·6°	7·2°	33·32	none	M. A. Adams.
Manchester....	" 12	c. colourless	none	·74	none	none	·0035	·0051	·0340	·1099	1·8°	1·8°	4·91	none	W. Thomson.
Newark	" 9	bluish green	none	1·78	trace	·037	·0009	·0043	none	·0989	17·0°	8·5°	35·00	diatoms and desmids	A. Ashby.
Newcastle-on-Tyne......	" 8	f. yellow	none	·76	trace	·044	·0010	·0110	·0060	·1300	11·8°	4·9°	15·40	satisfactory	J. Pattinson.
Norwich	" 9	s. grnsh. yellow	none	2·20	traces	·059	traces	·0070	·0386	·0400	15·0°	5·0°	16·40	satisfactory	W. G. Crook.
Nottingham ..	" 22	c. green. bluish	none	2·10	traces	1·250	none	·0005	none	·0100	15·0°	8·0°	29·80	veg. deb. & fibres animal.	Wigner & Harland.
Portsmouth ..	" 14	clear	none	1·17	traces	·419	traces	·0021	none	none	11·5°	2·0°	18·70	decomp. veg. deb. diams.	W. J. Sykes.
Reading	" 11	yellowish	none	1·00	trace	·144	·0014	·0063	·0040	·0560	14·8°	3·8°	21·75	vegetable debris	J. Shea.
Rochdale	" 17	pale blue	none	·50	none	·010	·0030	·0036	none	·0005	2·5°	2·0°	4·20	satisfactory	T. A. Collinge.
Salford	" 3	cloudy & yellow	none	·70	none	none	·0035	·0014	·0110	·0670	3·5°	3·0°	4·00	none	J. Carter Bell.
Shrewsbury ..	July 26	c. colourless	none	1·45		·300	·0010	·0015	none	none	22·0°	3·8°	26·00	none	T. P. Blunt.
Southampton ..	Aug. 18	yellowish	none	·98	trace	·476	·0033	·0043	·0096	·0980	12·3°	4·5°	19·40	vegetable debris	A. Angell.
Swansea	" 19	s. turbid	none	1·10	trace	none	·0010	·0063	·0040	·0040	3·0°	2·5°	4·90	earthy matter	W. Morgan.
Whitehaven ..	" 4	v. s. turb. p. grn.	none	·36	none	·009	none	·0017	none	·0151	·4°	·4°	2·07	veg. deb. diams. desmids	A. Kitchin.
Wolverhampton	" 13	s. yelw. tinge	none	1·29	trace	·065	none	·0042	·0013	·0448	13·7°	5·5°	21·42	veg. deb. spores diatoms	E. W. T. Jones.

Abbreviations:—c., clear; f., faint; h., heavy; p., pale; v. h., very heavy; v. s., very slight.

CORRESPONDENCE.

[The Editors are not responsible for the opinions of their Correspondents.]

SCHUYLKILL WATER.

To the Editor of "The Analyst."

Sir,—I send the following as a result of analysis of a sample taken from laboratory hydrant, July 19th :—

Smell at 100° F.	Slightly musty.
Chlorine	0·39 grns. per gall.
Saline Ammonia	0·0014 ,,
Albuminoid Ammonia	0·0084 ,,
Oxygen absorbed in two minutes	None. ,,
,, ,, ,, four hours	0·0630 ,,
Hardness before boiling	6·0°
,, after ,, ...	5·5°
Total solids	8·41 ,,
Sediment	None; water clear and colourless.

The increase of the various ingredients is due probably to the want of rain, and consequent diminished volume of water in the river.

Yours,

HENRY LEFFMAN, M.D.

715, *Walnut Street, Philadelphia, July 30th,* 1881.

WATER ANALYSIS IN NEW YORK.

To the Editor of "The Analyst."

Sir,—I have been much interested in the Papers on Water Supplies which have recently appeared in The Analyst, and the Directions of the Committee of the Society of Public Analysts.

My method of making ammonia and albuminoid ammonia determinations may not be acceptable, but I find it more convenient. I first put some 300 c.c. of water in the retort, with 25 c.c. carbonate of soda solution and distil until no more ammonia appears in the distillate, to clean retort, &c., then add the water 500 c.c., distil and nesslerize the distillate, and then, if I have more than one sample to test, add 500 c.c. and nesslerize again. Then, if the retort is not too full, add 50 to 80 c.c. permanganate solution, and distil until the distillate is free from ammonia; then add 500 c.c. more water and distil, and nesslerize the distillate which gives total. The difference between free and total would be albuminoid ammonia.

The method is, as you see, adopted from suggestions thrown out in various English publications on the subject, and when I have two or three waters at a time to test, it effects a great saving of time, and avoids any corrections for ammonia in the reagents, which I find is very common. I get results agreeing with themselves on the same sample much more readily than in any other way.

I should be glad to hear criticisms on the method.

As regards chlorine, if a water shows nothing high but that, it would take a sample almost impalatable to condemn it on that ground alone, though without very excessive amounts of other constituents, it might be reckoned as doubtful on account of the presence of some really innocent chlorides.

Yours, &c.,

School of Mines, New York. E. WALLER.

LAW REPORTS.

Adulterated Butter.—A Nice Question:—

Hamilton T. Hardman, provision merchant, at Sunderland, and the occupier of a stall in the Market, was charged by William McKay, inspector of nuisances to the Corporation, with selling butter adulterated to the extent of 76 per cent. with foreign fats, on the 30th June. Mr. F. M. Bowey, Deputy Town Clerk, appeared in support of the charge, and Mr. Marshall defended. The Inspector proved

buying the article as butter, and a certificate from Dr. Yeld, the borough analyst, stated that it was adulterated to the extent named. Mr. Marshall said he had an objection to the summons to raise. The alleged offence was committed at noon on the 30th June, and the summons was not served until the evening of the 28th July. He contended that as more than 28 days, allowed by law, had elapsed, the summons must break down. Mr. Bowey, in reply, said if the summons had not been served within 28 days, as regarded the hours, it had been legally served as regarding the days themselves. The Bench overruled the objection. Mr. Marshall said his defence to the charge was that the defendant's son, a little boy, who had perhaps somewhat carelessly been left in charge of the stall, had inadvertently sold butterine for butter, and even though an offence might thus have been committed, he asked the Bench to deal leniently with the defendant. The Bench considered the case proved, and fined the defendant 5s. and costs, a distress warrant to be issued in default.

A Mistaken Applicant:—

A poor woman came before the magistrate at the Lambeth Police Court and stated that she purchased some flour at a shop in order to have it analysed, as she had had some from the same place which she thought was adulterated. By the direction of Mr. Long, the inspector to the Newington Vestry, she took the flour to him, and he forwarded it to Dr. Muter, the analyst. She was afterwards given a printed certificate, and called upon, much to her surprise, to pay 10s. 6d. for it. The certificate stated that the flour had been received from Mr. Long for the purpose of being analysed. She was a poor woman, and thought it very hard she should have to pay.—Mr. Ellison said he had no power to interfere, but would, however, direct Sergeant Underwood to see the vestry clerk of Newington upon the matter.

In reference to above, Mr. Long, the sanitary inspector of St. Mary, Newington, afterwards appeared before the court. He said the woman had stated that she purchased some flour, believing it to be adulterated, and by the advice of Mr. Long had it examined by the Public Analyst, and that afterwards she was called upon to pay 10s. 6d., the fee of the analyst. Mr. Long, in explanation, informed Mr. Ellison, the Magistrate, that the woman was distinctly told by him that she would have to bear the cost of the analysis, and she expressed her willingness to do so: he therefore forwarded the sample to the Public Analyst. Mr. Ellison said he had informed the applicant he had no power to interfere, and after the explanation of Mr. Long, there was an end of the matter. Mr. Long hoped the same publicity would be given to the explanation as to the application.

Quinine Wine.—What is a Wine Glass?

George Trenchard Cox, grocer, of 1 and 2, Thayer Street, Manchester Square, appeared in answer to a summons taken out against him by the Marylebone Vestry through George Windle, inspector of nuisances, for selling a bottle of quinine wine not containing, as stated on the bottle, "one grain of sulphate of quinine in each wine-glassful." The analyst for Marylebone, Dr. Wynter Blyth, gave a certificate that in his opinion the wine contained three-fifths of a grain instead of a grain of sulphate of quinine in every two ounces. For the defence, it was urged that quinine wine was not a drug, but a beverage, and a license was required for its sale. The wine-glass, too, referred to was not such a one as was used in a chemist's laboratory, but such as was in common use. Dr. Attwell was called, and said he had tried the capacity of a large number of glasses, and found them to be from 2¾ ounces to 3½ ounces. The average of 20 glasses was 3 ounces. They were sherry glasses, and port glasses held 3¾ ounces. This quinine contained one grain of sulphate of quinine in each wine-glassful. Mr. De Rutzen said the whole question to be decided was, What was a wine-glass? Was it one used as a chemical measure or one in ordinary use? The analysts agreed that if it were the one in ordinary use there was a grain in it. Under the circumstances, he should dismiss the summons.

The Sale of Lime-water.—Richards *v.* Manfull:—

At the Guildhall, Nottingham, on August 3, Horatio John Manfull, of 88, Arkwright Street, Nottingham, chemist, was charged before Mr. Blain (in the chair) and Mr. F. W. Parsons that he did, on June 29 last, at Arkwright Street, Nottingham, unlawfully sell to one William Richards, chief inspector of nuisances, a certain drug, to wit, one pint of lime-water, which was not of the nature, substance, and quality of the drug or article demanded by the said William Richards. Mr. S. G. Johnson, town clerk, prosecuted on behalf of the Corporation, and Mr. Henry Glaisyer, solicitor, of Birmingham, represented the defendant. In opening the case, Mr. Johnson said there were three summonses returnable on that day against three chemists in the town for selling lime-water contrary to the 6th section of the Sale of Food and Drugs Act. He understood that two of them were not represented by professional men, but

that the third was represented by his friend Mr. Glaisyer, therefore, with the permission of the Bench, he would take Mr. Manfull's case first. He might tell the Bench that they had recently had a great deal of infantile diarrhœa in the town, and the attention of Mr. Seaton, the medical officer of health, had been called to the matter. In that town there were, as the bench would be aware, a number of women who went out to work during the day, leaving their children at home in the care of others. Lime-water was frequently used mixed with milk for dietetic purposes for such children, and it was of course of the utmost importance that the lime-water so used, and also that the lime-water ordered by medical men in prescriptions, should be of the best quality and of full strength, otherwise the health of the district must suffer, as the preparation in question was continually prescribed for diarrhœa, more particularly for children. Mr. Manfull being asked for a pint of lime-water, he was bound to supply a preparation known to the medical profession by that name, that of the Pharmacopœia, that being the only preparation a person going to a chemist's shop and asking for lime-water would expect to receive. Mr. Manfull had not been dealt with exceptionally in this matter. Twelve chemists' shops were visited by the inspector on the day the purchase of the drug in question was made from the defendant, and twelve samples of lime-water were taken, nine of which were of the required strength. The required strength, as he understood it, was distilled water thoroughly saturated with lime. Having read the 6th section of the Act, Mr. Johnson proceeded to say that it must stand to common sense that if a person went into a chemist's shop and asked for a drug he expected to get a drug of the nature, substance, and quality of the article demanded, and if that person asked for lime-water he would expect to get lime-water of the full strength, namely distilled water saturated with lime. If he did not get a preparation of that strength he did not get *lime-water*, but simply lime *and* water. He did not get the article he demanded, and he was prejudiced accordingly. In this particular case the Public Analyst had certified that the drug sold by the defendant was not lime-water, but lime and water, and did not contain more than about half the lime it should contain if of full strength, so that a medical man would be misled to the extent of half the lime in a prescription dispensed with the lime-water sold by the defendant. He should contend this point very strongly, because if it was contended for the defence that there was lime in the water sold, and that, consequently, the preparation sold was lime-water, he should call witnesses to show that there was a preparation known among chemists by that name, for which there was a well-recognised form of manufacture, which would produce a preparation of known strength, and that when a person asked for lime-water that preparation and no other should be sold, and that a person had a perfect right to expect to get that article, and was prejudiced if he did not get it of full strength. The matter was one of considerable public importance, and one which concerned the health of the whole district. He should call the medical officer of health, he should put in the analyst's certificate, and he should call the sanitary inspector and others. Mr. Glaisyer said, that with regard to the case in which he was instructed, he did not think there would be any necessity for his friend to go into the particulars of the case as sketched out, as he was prepared to acknowledge that the lime-water sold by the defendant did not contain the full proportion of lime, and he should only ask permission to address the Bench, and plead extenuating circumstances. Mr. Johnson said under the circumstances named by his friend, he did not think it necessary to go more fully into the merits of the case; he did not wish at all to make out a special case against Mr. Manfull. Mr. Glaisyer said the defendant, Mr. Manfull, had been in business in the town for eleven years, during which time he had carried on business in Arkwright Street, and that no charge of a similar nature to that they were now considering had ever been brought against him before with regard to the sale of any of his drugs. The inspector went to his shop and asked for lime-water, and he was supplied, as his friend opposite had told them, with an article which contained lime, but not lime in sufficient quantity to be that known to the medical profession and technically called lime-water. Now lime-water was made according to certain directions in the British Pharmacopœia, which ordered a certain quantity of lime to be put into a stoppered bottle containing a certain quantity of distilled water, and the ingredients to be shaken well for two or three minutes. "After 12 hours the excess of lime will have subsided, and the clear solution may be drawn off with a syphon as it is required for use, or transferred to a green glass bottle furnished with a well-ground stopper." He was told that each of these directions, the stoppered bottle, the shaking, the 12 hours' standing, the green glass bottle with the well-ground stopper, were all essential to the production of the proper article. Exposure to the air when shaken in a closed bottle would cause the lime which was in solution to be thrown down as a precipitate in the form of carbonate of lime, which would fall to the bottom of the vessel; and thus, of course, lessen the quantity of lime in the solution; therefore, even supposing the water were in the first instance saturated with lime, after exposure to the air a certain *quantity of* lime would be thrown out in the form of carbonate of lime. This would necessarily lessen

the quantity of lime contained in solution in the fluid. The shaking which the British Pharmacopœia directed was necessary in order to extend or separate the particles of slaked lime, and thus allow free access of the water to every particle, in order that it might take up the required quantity of lime to form a solution of the proper strength. The 12 hours' standing was also necessary for the same purpose. It was not a case where the law had been wilfully infringed or any attempt made to fraudulently adulterate a drug for the sake of gain, the total price of this article being only a few pence, nor was it a case in which a tradesman had wilfully and fraudulently sold an inferior preparation with greater profit; it was simply an instance where sufficient care had not been exercised in attending to the uttermost letter of directions contained in the British Pharmacopœia. With these remarks he would leave the matter in the hands of the Bench, submitting that, under the circumstances, a nominal fine would meet the justice of the case. Mr. Parsons said that although to the chemist the quantity of lime contained in lime-water might not make a pennyworth of difference, as regards the health of a large and populous town containing upwards of 200,000 inhabitants it was a most serious matter. Mr. Blain said: The Bench think this a very important question. The public must be protected, and, as this is the first offence, Mr. Manfull will have to pay £5.

George Powell, chemist, St. Ann's Well Rd., was charged with a similar offence. The Town Clerk said this was a case which was on all fours with the last. The defendant pleaded guilty, and was also fined £5.

Mr. J. T. Rayson, chemist, 273, Great Alfred Street, was also summoned for selling lime-water which was not of sufficient strength. Defendant said he had only had the shop a month, and his predecessor guaranteed that the lime-water was right. It was really no neglect on his part. Dr. Seaton, in answer to the Bench, said the lime-water ought to have been made since then, but if it had been put in a stoppered bottle there was no reason why it should not keep good for an even longer time. Defendant was also ordered to pay a fine of £5.

TRICHINOSIS DUE TO EATING FLESH OF A WILD BOAR.

We condense the following account by Dr. John Wortabet, of St. John's Hospital at Beyrout, of an outbreak of trichinosis in Palestine, from the London *Lancet:*

A wild boar was killed in the jungle near the village of Khiam, last November, and the meat, half cooked, or raw, was eaten by the villagers. During the second week afterward, the persons who had eaten, became ill, and if any escaped at that date they suffered later; but of those who had abstained not one fell ill. The symptoms of the disease were the same in all the victims; but those who ate the flesh raw suffered most severely, and the children generally suffered less than adults. The head of the boar was sent as a present to a family some miles north of Khiam, who boiled it very thoroughly before eating it, and though a good number joined in the repast no one of them suffered in the least. Dr. Wortabet visited the village on January 1 and 2, and found 257 persons more or less ill,—namely, men 121, women 101, children 35. Five others—three men and two women—had died before his arrival. The period of incubation does not seem to have ever been under ten days, though it was prolonged in some cases to twenty. In one individual, who had eaten the meat fairly cooked, the disease did not appear before the end of the fourth week, and then it was so slight that he was not laid up by it. They were unanimous in saying that up to the date of the actual invasion of the disease, they felt as well as usual. He heard, however, of one man who had vomiting and diarrhœa soon after eating, probably the effect of an overloaded stomach, and that he was one of those who had suffered the least. The instances in which the disease appeared later than the second week were very few. Some ten years ago there was a similar outbreak from the same cause in a village a few miles to the east, when about twenty persons lost their lives. He was told, also, that the wild boar lives chiefly on the roots of the canes which are abundant in the marshes, and as he burrows the ground with his snout he snaps up small animals, such as worms, snakes, and wild rats—the latter of which are said to be sometimes infested with trichinæ spiralis. A somewhat aged woman, whom he had seen quite ill when he was there, died afterward, and he succeeded in obtaining a piece of muscle (biceps brachialis), which reveals under the microscope a good number of trichinæ, and sets at rest any question as to the nature of the disease.

The editor of the *Lancet* adds this note on the results of a microscopic examination of the muscle:

"We received from Dr. W. a specimen of the muscle referred to in the postcript, and on microscopical examination found it to contain a large number of non-encysted embryo næmatoids. The isolated worms possessed the general shape, with terminal anus, met with in the embryos of trichinæ spiralis. They were too immature to admit of any details of organization being made out. They were found to be $\frac{1}{75}$ inch long by $\frac{1}{500}$ inch broad. The fact that they were non-encysted is in accordance with the other fact that they had not yet attained the usual size of encysted trichinæ."

J. Comyns Leach, M.D., B.Sc., F.C.S., has been appointed Analyst for the Borough of Shaftesbury.

The State of New Jersey has just passed an Act to prevent the Sale of Adulterated Food and Drugs, which, as well as the Act of the State of New York, contain the definition of adulterated articles as set out in the essay which obtained the prize offered by the National Board of Health already reprinted in this Journal.

We have received a copy of Messrs. Townson & Mercer's new catalogue. It is well illustrated, carefully sorted, and extremely complete. We think every analyst will find it advantageous to keep a copy of it for reference. Whether he uses it for purchasing by or not, he will certainly have a handy book at his side.

RECENT CHEMICAL PATENTS.

The following specifications have been recently published, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

No. 1880	Name of Patentee.	Title of Patent.	Price.
4988	K. W. Hedges	Electric Lamps	6d.
5014	J. Swan	Electric Lamps	6d.
5081	C. D. Abel	Purification of Sugar Juices, &c.	4d.
5146	W. Weldon	Obtaining Products from Residue of Manufacture of Sulphuric Acid by Cupreous Pyrites	4d.
5180	J. A. Dixon	Preparation of Alkali Salts of Sulphuric Acids	4d.
5191	C. A. Burghardt	Treatment of Fats and Oils for Manufacture of Soap	6d.
5374	J. J. Knight	Treatment of Mineral Phosphates containing Alumina and Oxide of Iron	4d.
5389	A. M. Clark	Extracting Juices, &c., from Sugar Cane	6d.
5394	W. Weldon	Manufacture of Bicarbonate of Soda	4d.
5478	H. A. Dufrené	Manufacture of Ammonia	6d.
1881			
65	P. M. Justice	Electric Lighting	6d.
153	A. Muirhead and J. Hopkinson	Electric Lamps	6d.
184	E. P. Alexander	Manufacture of Carbonate of Potassium	4d.
197	W. R. Lake	Treatment of Saccharine Liquids, &c.	6d.
222	W. Weldon and W. G. Strype	Purifying Hydrochloric Acid	4d.
289	J. A. Dixon	Production of Benzol Diacetate	4d.
728	C. Pieper	Manufacturing Magnesia, &c.	4d.
736	A. Sauvre	Drying and Refining Sugar	4d.
2226	G. S. Dean	Preparation of Nitro-Glycerin Compounds	4d.

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; Journal of Applied Science; The Boston Journal of Chemistry; The Provisioner; The Practitioner; New Remedies; Proceedings of the American Chemical Society; Le Practicien; The Inventors' Record; New York Public Health; The Scientific American; Society of Arts Journal; Sanitary Engineer of New York; The Cowkeeper and Dairyman's Journal; The Chemists' Journal; Oil and Drug News; The Textile Record of America; Sugar Cane; Country Brewers' Gazette; The Medical Record; Oil and Drug Journal; Analysis of Simpler Salts, by H. A. Phillips; Report of The People v. Schrumpf, New York; Butterine, Description of its Manufacture, by W. O. Westling; The Microscope (Detroit); Water and Air, their Relations to Health and Disease, by W. H. Watson; New Commercial Plants and Drugs, by T. Christy; Report on Croton Water, by Dr. E. Waller; Report on Stench Nuisances, by New York State Board of Health; *The City Record of New York.*

THE ANALYST.

OCTOBER, 1881.

SOCIETY OF PUBLIC ANALYSTS.

The Country Meeting of this Society was held on the 6th September at York, during the British Association Meeting. In the absence of the President, Dr. Wallace took the chair.

The ballot papers were opened by Mr. Jarmain and Mr. Baynes, and the following gentlemen were declared to be duly elected :—C. M. Blades, Analytical Chemist, Northwich ; C. Girard, Public Analyst for Paris ; C. T. Kingzett, F.C.S., F.I.C., Analytical Chemist, London.

The following gentleman was proposed for election :—W. J. R. Simpson, M.D., Aberdeen.

Mr. Allen read a paper "On the Relative Proportions of Olefines in Shale and Petroleum Products."

The Chairman, in addressing a few remarks to the meeting, congratulated the Society on the good work they had done during the past year in respect of the scheme they had published of water analysis ; and while speaking of it with great eulogium, expressed a hope that the Society would continue some similar labours in a new direction. He thought it would be worth while if the Society were to consider as to some new subject to be recommended to the Council for reference to a committee, who should be requested to frame a new series of instructions which would be of assistance to Public Analysts.

It was suggested that a good subject would be the preparation of a catalogue of the re-agents, which ought to be found in the laboratory of a Public Analyst, the sources from whence they can be best procured, and if requisite the best modes of their manufacture, the tests for their purity, and methods of purification where requisite.

ON THE RELATIVE PROPORTIONS OF OLEFINES IN SHALE AND PETROLEUM PRODUCTS.

By Alfred A. Allen.

Read before the Society of Public Analysts, at York, on 6th Sept., 1881.

In a previous Paper I have shown that some of the commercial products obtained by the distillation of bituminous shale differ from the parallel series of products derived from petroleum. As far as the action of strong nitric and sulphuric acids is concerned, this difference is fully recognised by those familiar with the products in question, and has been rightly attributed to the different proportions of olefines contained in them. The method of treatment of the hydrocarbon with fuming nitric acid, fuming sulphuric acid, and caustic soda used successively, is practically a process for the estimation of the paraffins, the hydrocarbons of all other series being destroyed or converted into soluble products.

One of the best known and most characteristic properties of the olefines or hydrocarbons of the ethylene series is the readiness with which they enter into combination with

the fraction. This suggestion of course assumes the absence of hydrocarbons of the acetylene series and other bodies simulating the olefines in their reaction with bromine.

Broadly speaking, the relative proportion of olefines present in two products of similar density and boiling-point is pretty exactly indicated by the power of assimilating bromine; and as the shale-products combine with from twice to ten times as much bromine as the parallel products from petroleum, it may be safely assumed that the former products are far richer in olefines than are the latter.

My acknowledgments are due to Mr. W. S. Gunn for the valuable assistance he has afforded me in ascertaining the bromine taken up by various products.

INLAND REVENUE REPORT.

The twenty-fourth report of the Inland Revenue Commissioners has just been issued, and we take from it the following report by the Principal of the Laboratory:—

The number of samples examined during the year ended 31st March last was 18,014, which is 2,901 in excess of the previous year. The increase is principally due to the operation of the new beer duty, and caused a great strain upon the department during the latter half of the year.

Under the Inland Revenue Act, 1880, which abolished the duty on malt, and imposed an equivalent tax on beer, 1,332 samples have been examined. Most of these were for the determination of the original gravity, to confirm or otherwise the gravity declared by the brewer or that found by the officer. As the samples examined at this laboratory are usually taken when the wort is in a partially fermented state, the conditions for obtaining an average sample are more favourable than before fermentation has commenced. The detection of sugar which has been illegally added to wort with the view of increasing the gravity has entailed a considerable amount of work of a kind requiring much skill and experience. We have so far successfully dealt with this form of fraud, and several prosecutions have been instituted against brewers, and a conviction obtained in each case. There appears to be a strong tendency among small brewers, more especially in the Midland Counties, who, through want of skill or attention, fail to get a produce of worts corresponding to the charge from materials, to use a quantity of sugar without entering it upon the brewing paper, and thereby escape payment of duty on a deficiency of produce from the malt. The per-centage of samples in which the true gravity has exceeded that declared has been very considerable.

As the mode of charging the duty on worts called into use a very large number of saccharometers intended as standards, and for general use by officers, the work of verifying many of these instruments fell upon this department. The result led to the rejection of many imperfect instruments.

Twenty-six samples under the Sale of Food and Drugs Act have been referred to us by direction of the magistrates. They comprised milk, butter, coffee, mustard, and tincture of quinine. In twelve instances our certificate agreed with, and in fourteen it differed from, that of the public analyst. In the case of two samples of butter said to contain foreign fat, our results showed that they were genuine butter. In another case a portion of the butter analysed by the defendant's analyst was sent here along with the sample in the hands of the

inspector. The results showed that the inspector's sample consisted almost entirely of foreign fat, and that the vendor's sample was a genuine butter. The magistrate held that the seller had improperly changed the sample left with him by the inspector, and thereby committed a fraud on the Court. In the case of two samples of coffee alleged to contain a large per-centage of chicory, traces only of the latter were found. Our analysis of a sample of tincture of quinine confirmed the results of the public analyst. We found that the tincture did not contain more than one-fifth the quantity of quinine found in the article as prepared according to the British Pharmacopœia, and that the quinine was partly replaced by other cinchona alkaloids. In several milk cases we differed from the opinion of the public analyst, as from the results of our analyses we were unable to affirm that water had been added or cream extracted.

In connection with the analysis of milk, and the results which we have obtained from an extensive inquiry into the composition of genuine milk, it is of some interest to direct attention to the confirmation which our results have received from those recently obtained by well-known analysts, and published in a scientific paper. In one instance the analyst found that two cows on the same farm gave milk which contained on the average 8·7 per cent. of solids *minus* fat, the minimum being 8·35. The average per-centage was calculated on the results obtained from an analysis of several milkings. In another case, in which the milk of a herd of 42 cows was analysed, it was found that 25 of the cows yielded milk which contained less than 9 per cent. of solids *minus* fat, the minimum being 8·25 per cent. The analyst's conclusion was that so far as house-fed cattle in Ireland are concerned, the standard of 9·0 per cent. should be reduced to 8·5 per cent. In the above cases the cows were all healthy and properly fed. As it is well known that public analysts generally have adopted 9·0 per cent. as a limit or standard for the "solids not fat" in deciding upon the genuineness of a milk, it is evident that vendors of a genuine milk similar in quality to those above referred to would be exposed to the danger of a prosecution. The results which these analysts have published are such as we have always felt convinced would follow a full and independent inquiry into the quality of milk yielded by different breeds of cows under the varying conditions of food and season, and the fact of these low results having been brought under the notice of the public removes any difficulty we have hitherto felt in publishing our own investigations on the same subject.

The sale of light and non-intoxicating beverages made from sugar and variously flavoured with hops and other materials has increased very much during the past two years. These are sold under the suggestive names of "Non-pale Ale," "Tonic Stout," "Tonicine," "Hopetta," "Champagne Coffee," &c., &c. The stimulus appears to have been given to their sale partly by very successful attempts at imitating ordinary beer in general appearance and flavour, and also by the fact that the influence of the temperance movement throughout the country is largely directed to the promotion of the sale of non-intoxicating drinks as a means of reducing the consumption of alcoholic beverages. In many instances the aëration of the beverage is carried on by causing a slight fermentation to take place in the liquor. As this continues in some cases for a considerable time in the bottle, an amount of alcohol is produced, including that added with the flavouring ingredients, equal to from 4 to 6 per cent. of proof spirit. As these preparations are usually employed as temperance drinks, it is evident that they are not in every case so innocent as they are supposed to be, and I am

of opinion that such of them as approach the character of light table beer should, in justice to the brewing trade, be subjected to the beer duty.

The analysts have attended before the magistrates to give evidence in 21 cases in which prosecutions have arisen, and penalties amounting to £314 were imposed.

Forty-one samples have been examined for the Stationery Office, twenty-eight of which were writing ink, eleven liquid gum, and two silk cord.

Twelve examiners have received the usual course of instruction.

Eight students during the year completed the customary course of instruction at the Royal School of Chemistry and in the class of practical chemistry at this laboratory. At the final examination by Dr. Frankland they specially distinguished themselves by taking a high position, and all received first-class certificates.

REPORT OF THE LOCAL GOVERNMENT BOARD.

We take the following from the Blue Book recently published :—

In our last Report, we stated that up to the 31st of December, 1879, the number of Authorities who had appointed analysts, with our approval, was as follows :—

County Authorities	52
Municipal Corporations	139
District Boards and Vestries in the Metropolis	39
	230
Agreements entered into under section 11 of the Statute ...	7
	237

During the year ending on the 31st of December, 1880, appointments were made under section 10 by the authorities of 17 additional boroughs, including one in which an arrangement had previously been made under section 11, and consequently, the total number of authorities who, up to the last-mentioned date have availed themselves of the salutary provisions of this important Act is 253.

We are still in correspondence with the few remaining Authorities who have not yet complied with the provisions of the Statute, and we trust that they will not fail to recognize the expediency of making the requisite arrangements in this respect.

The result of the analyses made during the year is shown in the abstract which is printed in the Appendix. It will be seen that the total number of such analyses is 17,678, or about 500 more than in 1879. Taking the population of England and Wales at twenty-five millions and a half, we find that one sample was analysed for every 1444 persons, a proportion which is perhaps as large as could have been fairly expected considering that the Sale of Food and Drugs Act has at present only been five years in operation. We should be glad, however, to see at least one sample taken annually for

every thousand persons throughout the country, and it is unfortunate that many Local Authorities cannot be induced to exercise their powers under the Act. In London, and in about half-a-dozen extra-metropolitan counties, the proportion last referred to is already more than attained, but in twelve English and at least half as many Welsh counties the Act is practically inoperative. In one district in London, that of St. Mary, Newington, no samples were analysed, and in Whitechapel, Shoreditch, Rotherhithe, and several other Metropolitan Districts the number bore an insignificant relation to that of the inhabitants as well as to that of the vendors of articles coming within the scope of the Act. In comparatively few of the smaller boroughs was any action taken in this respect, and even in such populous towns as Birkenhead, Derby, Durham, Exeter, Hartlepool, Northampton, Oxford, and York, either no samples at all, or scarcely any, have been analysed. In many such cases we have endeavoured to induce the Authorities to exercise the power conferred upon them by the 13th section of the Act of 1875, of having samples subjected to analysis from time to time, but we have too often been unable to obtain more than a general statement that as adulteration is not suspected to exist the Town Council deem it unnecessary to harass the local tradesmen. Scarcely enough weight seems to be given in these instances to the fact that the experience of places where samples are analysed shows adulteration to be prevalent to a greater or less extent; and to the consideration that tradesmen who sell genuine goods are not in the least harassed by parting with such goods, at current prices, to an inspector, while they are exposed to serious loss if their rivals are enabled to undersell them by unchecked malpractices. As regards the counties, in several instances the Courts of Quarter Sessions have declined to have samples obtained, apparently on the ground that the duty may properly be left to the Sanitary Authorities, while the Sanitary Authorities have as a general rule done nothing, perhaps because they consider that the work of collection can be best performed by the county police who are under the control of the magistrates. Whichever view be adopted, we are satisfied that it is of great importance that some of the officers specified in the statute should be required to act. On one point experience seems to be conclusive, namely, that where the Authorities do not obtain samples, the Act is scarcely carried out at all. Ordinary purchasers, except in a very few instances, are not found willing to incur the trouble and expense of analyses; and the official purchases amount to about 97 per cent. of the whole. Bristol is almost the only town in which any large number of analyses have been obtained by private individuals, and perhaps this exception is due to the fact that the Town Council have arranged with their salaried analyst to examine each sample for half a crown, instead of the usual fee of half a guinea, which is the maximum allowed by the Act. In Lambeth the Vestry have adopted the plan of notifying to the public that any person believing his purchases to be adulterated may give notice to the Inspector, who will thereupon, with the necessary formalities, obtain some of the suspected article and submit it to the Public Analyst.

The following table shows the number of samples examined during the year and the per-centage of cases in which adulteration was reported. It must be remembered, however, that this per-centage includes a very large number of cases in which the adulteration was so small that no proceedings were instituted, while in some instances the prosecution failed because it was shown that due notification of admixture had been given by the vendor.

—	Examined.	Adulterated.	1879. Percentage of Adulteration.	1880. Percentage of Adulteration.
Milk	6,751	1,448	19·4	21·4
Bread	1,096	70	7·3	6·4
Flour	409	4	2·4	1·0
Butter	1,155	211	13·0	18·3
Coffee	1,211	233	18·9	19·2
Mustard	872	138	19·0	15·8
Pickles (including Tinned Vegetables)	46	1	2·2	2·2
Sugar	244	—	0·4	—
Jam	29	2	1·9	6·9
Confectionery	174	—	1·5	—
Wine	67	13	10·7	19·4
Beer	465	19	3·6	4·1
Gin	769	155	21·7	20·1
Spirits other than Gin	1,289	334	30·8	25·9
Drugs	405	63	27·8	15·5
Other Articles	2,691	81	6·1	3·0
Total	17,673	2,772	14·8	15·7

It will be seen from this table that the per-centage of adulterated samples, which fell from 19·2 in 1877, to 17·2 in 1878, and 14·8 in 1879, again rose to 15·7 in 1880. This result is principally accounted for under the two heads of milk and butter.

More than a third of the whole number of samples examined were of milk, and we regret to find that the improvement in the quality of this article, which we were able to record in the two previous years, was not maintained in 1880. The per-centage of adulteration throughout England, which had fallen from 24·1 in 1877 to 19·4 in 1879, was 21·4 in 1880. In the Metropolis no less than 27·5 per cent. of the samples taken were reported against.

The proportion of milk adulteration detected varies very much in different districts. As regards the Metropolis we find that in the city of London 16 samples out of 26 are reported against, in Marylebone 9 out of 14, in St. Olave 8 out of 12, in Woolwich 43 out of 81, in Paddington 36 out of 79; while in Lambeth the proportion is only 16 out of 197, in Wandsworth 10 out of 117, and in St. James's Westminster all the samples were found genuine. This last-mentioned district, by the way, seems to enjoy a singular immunity either from adulteration or from its detection; for out of 220 samples of all kinds examined during 1880 not one was found adulterated, and 67 samples were examined in 1879 with a similar result. We have no information as to how the samples in question are collected, but the case is so exceptional as to deserve special notice.

Of the eight most populous provincial towns, we find that Birmingham again figures conspicuously with 39 adulterated samples of milk out of 82 examined, Manchester has 35 adulterated out of 119, Salford 73 out of 298, Bristol 36 out of 144, Sheffield 4 out of 25, Liverpool 34 out of 277, Bradford 7 out of 60, and Leeds 4 out of 42. All these towns, therefore, except Birmingham and Manchester, are better off in this respect than the Metropolis.

No doubt the ease and profit of milk adulteration make its suppression a matter of great difficulty; but we had hoped that the measures adopted under the Act would have produced a continued diminution in this description of fraud. In some cases the amount *of added water* is so large as to be, according to the analyst for Plumstead, "a serious

matter for health, and even for the lives of infants." At Salford some of the samples contained more than 30 per cent. of added water, the defence put forward being that this was merely owing to the cows having been poorly fed. In one case the farmer swore that he had fed his cows on nothing but straw, and the analyst remarks that if this defence were true the case would have been suitable for investigation by the Society for the Prevention of Cruelty to Animals. The same analyst states that he had visited several farms when he was not satisfied with the milk delivered from them to the dealers, had seen the cows milked, analysed the milk, "and thus judged the farmer by means of a jury of his own cows." The analyst for Durham, in reference to the difficulty of distinguishing between adulterated milk and milk that is genuine but very poor, suggests that the farmer who disputes the accuracy of an analysis, and pleads the natural poverty of particular milk, should be required to call in the analyst to see the cow milked, and to take a sample for comparison, and that till this has been done no appeal should be allowed. The fact that the milk trade is largely in the hands of petty dealers has probably led in some instances to leniency as regards the amounts of the penalties imposed, and the frequent repetition of the offence by the same persons shows that they often find it profitable to pay the fines and go on adulterating. In one case which was the subject of proceedings in the past year the milkman was not deterred by seven previous convictions, under which he had paid an aggregate of over £70 in fines alone, and on the eighth conviction was mulcted in the full penalty of £20 and costs.

The provision of the Act of 1879 authorising the taking of samples at railway stations before delivery to the retailers, has been found very useful, by enabling the dairyman to protect himself against the consignment to him of adulterated milk. Some doubts at first arose as to the mode of carrying out this section, for it would be obviously impracticable, in most instances, to observe the formalities, as to notice of analysis and division of sample, which are enacted by section 14 of the Act of 1875 for the protection of the seller. This supposed difficulty, however, was removed by the decision of the High Court of Justice that the procedure referred to was not applicable to the case. The honest milkman is thus effectually protected, and the dishonest one who sells watered milk has at least the satisfaction of being able to make sure that he has not been anticipated in watering it: the public, too, escape the double dilution. It is not surprising to find that samples taken at the railway station are as a general rule of much higher quality than those bought from the retailers. The analyst for Liverpool observes, that of 80 samples so taken, all but two were found genuine, and that the average quality was at least 15 per cent. richer than the average quality of milk purchased by the inspectors from dairymen, even omitting samples known to be watered.

Of the samples of bread examined about 6·4 per cent. are reported against, and this result compares very favourably with previous returns. The adulteration was generally alum, introduced in order to whiten the bread, but likely to impair the digestive organs, if taken in large quantities; and bread such as that reported by the analyst for Essex as containing no less than 1,305 grains of alum to the quartern loaf, would no doubt have been exceedingly harmful to anybody whom its nauseousness did not prevent from consuming it. Nor would oatcakes containing 10 per cent. of chalk, as reported by the Cheshire analyst, be wholesome food. Baking powder appears to be responsible for some of these admixtures

and the question has been much discussed whether the use of certain kinds of aluminous powder does in effect make bread injurious to health, or whether, as contended by the manufacturers, such bread is no less wholesome than that baked with ordinary yeast. One analyst, however, reports the discovery in some "Baker's Mixture" of a considerable amount of arsenic, due to its having been made from impure chemicals, and he comments on the danger of introducing so virulent a poison into bread.

By the use of such mixtures, usually manufactured from phosphates of lime and magnesia treated with sulphuric and hydrochloric acids, bakers are enabled to make bread of good appearance from inferior flour. The flour as sold, however, is very little tampered with, only four samples out of 409 having been reported against, among which was some so-called "Russian flour," that consisted solely of potato starch with a little sulphate of lime.

A good deal of attention has been directed during the year to the increased consumption of butterine, which is beginning to take an important place as a substitute for butter among the poorer classes. Some of this substance is reported to be "so close an imitation of the real article, that a very careful chemical analysis is necessary to distinguish the two," although it is usually sold at about 1s. a pound or less. Its wholesomeness has been called in question in America, but among English Public Analysts there seems to be a concurrence of opinion that it is unobjectionable in this respect, and no trichinæ or other living organisms appear to have been detected in it. There is no doubt, however, that it is too often sold where butter is asked for, and the similarity of name probably aids in this deception; for in one case in which proceedings were taken, it was shown that a label containing the words "10d. per lb." had been placed so as to hide the last syllable of the word "Butterine."

The per-centage of adulterated samples of coffee remains about the same as in previous years. Chicory continues to be the chief adulterant, and the cases are numerous in which the proportion added is very large. One sample of so-called coffee was found to consist entirely of this inexpensive root; and an article extensively sold as "French coffee," has been ascertained from various analyses, to contain from 40 to 70 per cent. of chicory. In one case, indeed, we learn from an analyst's report that the vendor of a preparation advertised as "Fine French coffee, a blend of finest East India and other coffees, carefully prepared by the new French process, whereby the aroma and properties of the coffee are fully developed," was prosecuted and fined, because the French developing process was discovered to have consisted solely in the mixture of the enormous proportion of 90 per cent. of chicory with 10 per cent. of coffee. Another substance sold as "Turkish Luxury," was composed of three parts of chicory, added to one of coffee. As chicory is stated to be destitute of the active principle and volatile oil which are the most valuable properties of coffee, its unacknowledged admixture with coffee is objectionable from a dietetic point of view, though it is exceedingly profitable to sell an article that costs about 4d. a pound at the price of genuine coffee.

The so-called adulteration of mustard is really to some extent a question of nomenclature. Most people, in buying mustard for table purposes, desire not ground mustard seed alone, but the preparation which it is now necessary to label as a mixture.

All the 244 samples of sugar examined were pronounced to be genuine, and the *application of* adulteration to this article may now be regarded as obsolete. We are glad

to remark, too, that in the sweetmeats examined no instance was found of the use of those deleterious colouring matters which were formerly extensively employed.

Of wines only 67 samples were examined, and nearly all were found genuine, except some so-called "unfermented" wines sold as "Temperance Drinks," which professed to be composed of pure grape juice, but were really mixtures of tartaric and salicylic acids, sugar, and flavouring matter. Some of these also contained a dangerous amount of copper, due probably to the manufacture having been carried on in vessels of which the acids had dissolved part of the metal. In several instances spirit was also present, notably in one sample labelled, "The selected Wine of the Temperance Fraternity," which was reported as "containing a large amount of alcohol." Some samples of ordinary Tent wine were also examined, and were found to have been brandied, one of them so freely as to make it contain the enormous proportion of 40 per cent. of proof spirit.

Very little adulteration of beer has been detected. In the Metropolis, the 127 samples examined were without exception reported as genuine; and in the rest of the country the few samples reported against for the most part merely contained an excess of salt. In Chester, however, some samples were reported as "only coloured alcoholic waters, which were not produced from pure malt and hops; some contained a considerable amount of salt, more than twenty times what is found in good beer." It may be also that sugar and water are occasionally added to beer, and that this addition escapes detection on analysis owing to the speedy conversion of the sugar used; but the deleterious forms of adulteration appear to exist no longer.

In spirits the per-centage of adulteration remains high, although it might have been anticipated that the lowness of the standards of genuineness fixed by the Act of 1879 would have produced a different result. In most cases water alone was added, sometimes with caramel as colouring matter. One sample was reported as containing decaying vegetable matter with fungoid growth, apparently due to its having been diluted with dirty water.

In drugs a substantial improvement is shown, the proportion adulterated being little more than half what it was in 1879. In some instances a cheap substitute had been purposely employed in place of a costly drug, as "cinchonine" in lieu of quinine. In other instances, the sale of one article in place of another was probably due to a mistake, as where sulphate of zinc was issued instead of Epsom salts. In other instances, drugs were found to be considerably below the strength specified in the British Pharmacopœia, sometimes no doubt owing to intentional dilution, but probably sometimes, as in the case of sweet spirits of nitre slightly deficient in nitrous ether, owing to the accidental escape of volatile spirits which had originally been present. In one class of cases which generally figures conspicuously in these returns, chemists are not the delinquents. A good many of the samples were those of so-called "paregoric," which were reported as adulterated because they were destitute of the opium which is the most important constituent of the genuine compound. The fact is, according to the analyst of the West Riding of Yorkshire, that such substitutes are ordinarily sold by small shopkeepers who are not chemists, and who therefore are prohibited by the Pharmacy Act from dealing in an article containing poison. On the general question of the adulteration of drugs, we may refer to the observations in our previous reports, and may reiterate our opinion that the importance of obtaining pure medicines makes it desirable that a larger number of samples than heretofore should be submitted for analysis.

Of the articles not specified by name in the table printed above, some of the principal were arrowroot, oatmeal, tea, pepper, aërated waters, and tinned meat and fruits. Arrowroot was occasionally found adulterated with tapioca, flour and similar substances, and oatmeal with barley flour. Tea was in some cases reported to have been made up with exhausted leaves and to have been faced to excess, but the instances of this were so rare as to show that the examination of tea in bond by the analysts of the Commissioners of Customs has produced an excellent effect on the retail trade. Pepper was almost uniformly genuine. Among the aërated waters, instances were again found of the introduction of lead by careless processes of manufacture. The result of the analysis of tinned foods was on the whole decidedly satisfactory, although in one or two instances either the soldering or the tin had been corroded, and part of the metal had been absorbed in the liquid contents so as doubtless to render them unwholesome.

Of the 17,673 samples above referred to all but 337 were obtained by officers appointed under the Act of 1875. Of those purchased privately about one-third were found adulterated, of those purchased officially about one seventh. This difference is of course mainly explicable by the fact that a private purchaser's suspicion of adulteration is ordinarily pretty strongly aroused before he bestirs himself to put the Act into operation on his own account. Moreover, there is little doubt that in some cases of official purchases sufficient care is not taken to prevent the inspector being recognised as such, and served with a superior article.

Several important decisions of the High Court of Justice have been given during the year with reference to the Sale of Food and Drugs Acts. In the case of Horder v. Mannings, an inspector having asked for coffee was served with an article taken from a canister labelled "Symington's coffee." He thereupon stated that he wanted the coffee for analysis, on which the vendor put it into a paper labelled "this is sold as a mixture of chicory and coffee," and delivered it to him. The "coffee" being found by the analyst to contain 85 per cent. of chicory, it was held that it was no defence for the vendor that he sold it just as he had received it from the manufacturer, for if he was cognisant of so great a proportion of chicory to coffee in the article sold, he made himself a party to the manufacturer's fraud (44 J. P. 234). In the case of Horder v. Scott it was decided that an inspector appointed under the 13th section of the Act of 1875 may employ a deputy to purchase articles for the purpose of analysis, and may properly institute proceedings against the seller of such articles if the result of the analysis discloses an offence against the Act (L. R. 4 Q. B. D. 552). In the case of Rouch v. Hall (already referred to) a sample of milk from the country was taken at Euston station, and it being assumed that the procedure prescribed by section 14 of the Act of 1875 was applicable to section 3 of the Amending Act of 1879, notification of analysis was given to a railway porter in charge of the milk, and one-third of the sample was left with him. On this it was held that although the porter could not be regarded as the agent of the consignor, yet where a sample of milk in course of delivery is procured for analysis under section 3 of the Act of 1879, it is not necessary for the officer procuring such sample to notify to the seller or his agent his intention of having the sample analysed, or to deliver to the seller or his agent a portion of the sample in accordance with section 14 of the Sale of Food and Drugs Act, 1875 (*L. R.* 6 Q. B. D. 17).

TOTAL NUMBER OF SAMPLES.

	Examined.	Adulterated.	Proportion adulterated. 1880.	1879.
The Metropolitan District	5039	734	14·5	12·7
COUNTIES.				
Bedford	313	22	7·0	12·1
Berks	78	12	15·4	7·8
Bucks	—	—	—	0·0
Cambridge	62	8	12·9	24·3
Chester	940	185	19·6	15·3
Cornwall	11	7	63·6	42·8
Cumberland	105	11	10·4	12·6
Derby	104	30	28·8	29·8
Devon	72	16	22·2	26·2
Dorset	16	9	56·2	—
Durham	568	127	22·3	29·7
Essex	331	13	3·9	6·4
Gloucester	638	45	7·0	7·5
Hereford	—	—	—	0·0
Herts	—	—	—	100·0
Hunts	18	13	72·2	0·0
Kent	441	94	21·3	27·7
Lancaster	2539	446	17·5	17·4
Leicester	265	33	12·4	9·7
Lincoln	283	30	10·6	16·4
Middlesex	284	46	16·2	23·1
Monmouth	84	23	27·4	25·0
Norfolk	98	31	31·6	29·1
Northampton	108	13	12·0	15·2
Northumberland	193	33	17·1	12·2
Nottingham	44	9	20·4	19·0
Oxford	15	6	40·0	25·0
Rutland	10	2	20·0	—
Shropshire	13	2	15·4	0·0
Somerset	723	40	5·5	5·6
Southampton	428	73	17·0	21·0
Stafford	1006	162	16·1	12·6
Suffolk	4	2	50·0	0·0
Surrey	500	105	21·0	13·2
Sussex	339	57	16·8	10·0
Warwick	260	67	25·7	22·8
Westmoreland	16	3	18·7	16·6
Wilts	107	8	7·4	5·7
Worcester	154	22	14·2	12·4
York, E. Riding	144	26	18·0	18·2
„ N. Riding	70	14	20·0	14·3
„ W. Riding	578	99	17·1	21·0
WALES.				
Anglesey	3	1	33·3	15·3
Brecknock	79	24	30·4	66·1
Cardigan	13	4	30·7	—
Carmarthen	18	2	11·1	17·1
Carnavon	6	4	66·6	—
Denbigh	9	2	22·2	25·0
Flint	20	9	45·0	7·4
Glamorgan	467	36	7·7	5·1
Merioneth	26	2	7·6	—
Montgomery	–	—	—	0·0
Pembroke	16	5	31·2	—
Radnor	15	5	33·3	—
Totals	17673	2772	15·68	14·88

SOCIETY OF PUBLIC ANALYSTS.

Analyses of English Public Water Supplies in September, 1881. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Date when drawn.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine in Chlorides.	Phosphoric Acid in Phosphates.	Nitrogen in Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in		Hardness, Clark's Scale, in degrees.		Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
									15 mins. at 80° Fahr.	4 hours at 80° Fahr.	Before Boiling.	After Boiling.			
Kent Co.	Sept. 16	clear, pale blue	none	1·98	trace	·672	none	·0026	.0020	.0080	19·0°	6·4°	31·80	satisfactory	Wigner & Harland.
New River	,, 15	clear	none	1·12	trace	·189	·0006	·0014	·0210	·0310	14·0°	3·0°	18·76	satisfactory	B. Dyer.
East London ..	,, 14	c. yellow green	none	1·37	trace	·178	·0015	·0066	none	·0380	13·0°	4·2°	19·80	vegetable debris	Wigner & Harland.
Southwark & Vauxhall ..	,, 17	c. v. p. yellow	none	1·24	trace	·150	·0005	·0070	·0280	·0616	13·5°	3·5°	21·15	satisfactory	J. Muter.
West Middlesex	,, 19	yellow green	none	1·17	trace	·141	·0006	·0045	·0510	·0810	12·4°	2·7°	19·66	vegetable debris	O. Hehner.
Grand Junction	,,	p. grnsh yellow	none	1·12	trace	·210	·0008	·0067	·0064	·0984	13·0°	3·5°	18·40		A. Wynter-Blyth.
Lambeth	,, 02	c. v. p. yellow.	none	1·24	trace	·150	none	·0063	·0250	·0504	13·5°	3·5°	21·28	satisfactory	J. Muter.
Chelsea	,, 12	c.p.brnsh. green	none	1·19	trace	·230	none	·0060	·0420	·0870	11.5°	3·5°	18·48		A. Dupré.
Birmingham ..	Sept. 5	grnsh. ylw. turb.	none	1·40	trace	·198	·0014		·0084	·0440	8·8°	5·4°	16·83	veg. deb. & liv. veg. frms.	A. Hill.
Bolton........	,, 7	s. turbid	none	·50	none	·030	·0016	·0048	·0035	·0150	3·5°	3·5°	8·70	mineral matter	W. H. Watson.
Bradford	,, 21	pty.yel.v.s.opqe.	none	·65	none	none	none	·0042	·0350	·1650	3·5°	3·4°	7·7	none	F. M. Rimmington.
Brighton......	,, 9	c. pale blue	none	2·05	none	·350	·0028	·0019	none	none	13·0°	3·4°	19·80	vegetable debris	Wigner & Harland.
Bristol........	,, 6	pale green	none	·68	trace	·093	·0013	·0056	·0210	·0588	14·0°	1·5°	18·40	algæ sand	F. W. Stoddart.
Bury (Lan.) ..	,, 7	s. turbid	none	·82	none	·042	·0032	·0093	·0060	·0210	4·5°	4·4°	8·80	mineral mttr. & veg. deb.	W. H. Watson.
Cambridge	,, 13	c. pale blue	none	1·40	traces	·413	·0004	·0020	none	·0103	17·0°	4·5°	23·80	satisfactory	J. West Knights.
Canterbury	,, 12	c. pale blue	none	1·47	none	·387	·0005	·0008	·0020	·0104	5·4°	4·0°	8·68	slight mineral	S. Harvey.
Darlington	,, 13	s. turb yel. grn.	s. peaty	·63	trace	·011	none	·0063	·0150	·2823	6·3°	3·9°	9·80	earthy matter	W. F. K. Stock.
Edinburgh	,, 9		none	·64	none	trace	·0024	·0064	·0128	·1027	4·7°	4·0°	6·08	none	J. Falconer King.
Exeter........	,, 4	l. brnsh. yellow	none	·84	trace	·127	·0014	·0031		·0861	2.8°	2·8°	5·60		F. P. Perkins.
King's Lynn ..	,, 14	yellow opaque	weedy	1·68	traces	·245	·0005	·0098	·0368	·3252	12·8°	4·3°	21·21	animalculæ veg. debris	W. Johnstone.
Leeds															
Leicester......	,, 19	s. yellow	none	1·10	traces	·073	·0011	·0025	·0030	·0720	7·5°	5·0°	15·70	satisfactory	W. L. Emmerson.
Liverpool	,, 14	grnsh. yellow	s. peaty	1·02	traces	·031	·0021	·0056	·0530	·0780	3·4°	3·2°	7·14	slt. deposit, confervæ, &c.	A. Smetham.
Maidstone—															
Wtr. Company	,, 14	clear green	none	2·80	traces	·230	·0007	· 0 35	·0084	·0168	19·0°	6·6°	39·41	none	M. A. Adams.
Public Conduit	,, 14	c. light blue	none	2·30	traces	·280	none	·0021	·0028	·0140	20·0°	6·6°	35·28	none	M. A. Adams.

SOCIETY OF PUBLIC ANALYSTS.

Analyses of English Public Water Supplies in September, 1881. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Date when drawn.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine in Chlorides.	Phosphoric Acid in Phosphates.	Nitrogen in Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in 15 mins. at 80° Fahr.	Oxygen, Absorbed in 4 hours at 80° Fahr.	Hardness, Clark's Scale, in degrees. Before Boiling.	Hardness, Clark's Scale, in degrees. After Boiling.	Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
Manchester....	Sept. 16	s. turb. f. yellw.	none	·61	none	none	·0042	·0045	·0439	·0658	2·7°	2·2°	5·51	s. mineral	W. Thomson.
Newcastle-on-Tyne......	,, 8	f. yellow	none	·79	trace	·040	·002	·0110	·0890	·1440	13·4°	4·9°	16·30	satisfactory	J. Pattinson.
Norwich	,, 12	p. grnsh. yellow	none	1·90	trace	·032	traces	·0019	·0443	·0828	11·0°	3·8°	13·60	satisfactory	W. G. Crook.
Nottingham ..	,, 23	c. green blue	none	·149	traces	·625	·0129	·0119	none	none	9·8°	6·6°	17·80	veget. deb. animalculæ.	Wigner & Harland
Plymouth	,, 15	turb. brnsh. grey	none	·34	none	none	none	·0114	none	·0420	2·0°	2·0°	3·76	vegetable debris	R. Oxland
Portsmouth ..	,, 14	s. turbid	none	1·15	trace	·203	trace	·0018	none	none	13·5°	2·0°	19·30	dec. veg. mtr. & diatoms	W. J. Sykes.
Reading	,, 14	f. yellow	none	·11	trace	·150	·0007	·0049	·0028	·0450	13·5°	4·0°	18·77	none	J. Shea.
Rugby	,, 4	p. yel. f. turbid	v. faint	1·48	trace	·097	·0028	·0261	·0430	·0936	11·8°	10·6°	15·4	veg. debris, bacteria, &c.	A. P. Smith.
Salford	,, 1	c. bright yellow	none	·70	none	none	·0007	·0021	·0163	·0728	3·5°	3·0°	3·5	none	J. Carter Bell.
Shrewsbury ..	,, 5	c. colourless	none	1·45	traces	·264	none	·0010	·0036	·0073	23·0°	4·0°	25·0	none	T. P. Blunt.
Southampton ..	,, 20	yellowish	none	1·40	h. trace	·490	·0023	·0063	·0090	·0880	12·5°	4·3°	17·3	vegetable debris	A. Angell.
Swansea	,, 17	s. turbid	none	1·00	trace	none	·0010	·0053	·0030	·0040	3·0°	2·5°	4·55	none	W. Morgan.
Tunbridge Wells	Aug. 23	brnsh. yellow	none	2·10	trace	·219	·0005	·0006	none	none	4·4°	2·6°	8·34	satisfactory	A. H. Hassall.
Warwick	Sept. 6	c. greenish	none	1·47	none	·369	·0007	·0028	·0315	·0497	23·6°	12·6°	26·04	none	A. Bostock Hill.
Whitehaven ..	,, 1	c. f. green	none	·35	traces	·006	none	·0017	·0052	·0170	·4°	·4°	1·89	satisfactory	A. Kitchin.
Wolverhampton	,, 16	s. yellow	none	1·33	traces	·095	none	·0035	·0028	·0173	13·1°	6·2°	21·56	veg. debris, diatoms	E. W. T. Jones.

Abbreviations:—c., clear; f., faint; h., heavy; p., pale; v. h., very heavy; v. s., very slight.

THE ANALYSES OF THE PUBLIC WATER SUPPLIES OF ENGLAND.

Tunbridge Wells.—The sample tested was taken from the covered reservoir at Pembury, about four miles from Tunbridge Wells; this reservoir is supplied by seven different springs in the neighbourhood, the quality of each of which differs somewhat, but the sample tested represents the mixed water of all the springs. From Pembury the water is pumped to the Blackhurst reservoirs, which are also covered, and which are at sufficient elevation to allow of the supply of the higher parts of the town, as Mount Ephraim. The supply is on the intermittent system, and in summer is somewhat deficient in quantity. Fresh reservoirs are, however, about to be constructed, capable of holding a three months' supply.

THE PUBLIC WATER SUPPLIES OF ENGLAND.

VALUATION, ACCORDING TO WIGNER'S VALUATION SCALE, OF THE ANALYSES PUBLISHED THIS MONTH.

In the following table we give the *average* valuation of the public water supplies from January to June, and the valuation of the July, August and September waters.

	Average to June.	July.	August.	Sept.
LONDON—				
Kent	30	27	20	27
New River	26	17	17	21
East London	32	39	20	28
Southwark and Vauxhall	34	28	31	27
West Middlesex	30	24	29	39
Grand Junction	30	23	25	30
Lambeth	37	29	31	26
Chelsea	30	26	32	36
Bath	12	19	20	..
Birmingham	33	37	26	29
Bolton	..	17	19	17
Bradford	53	53	59	44
Brighton	24	23	25	21
Bristol	22	27	..	30
Bury	..	35	24	24
Cambridge	28	26	22	21
Canterbury	17	22	16	12
Coventry	33	..	..	..
Croydon	27	30	..	..
Darlington	33	39	96	50
Derby	18	13	..	..
Droitwich	39	..	..	..
Dublin	23	..	13	..
Dudley	45	..	..	..
Edinburgh	28	21	20	24
Exeter	20	16	23	23
Grantham	27	..	32	..
Hastings	..	20	25	..
Huddersfield	23	26	28	..
Hull	23	..	..	..
Ipswich	27	30	30	..
King's Lynn	94	110	48	110
Leamington	26	..	26	..
Leeds	35	28	22	..
Leicester	42	24	26	23
Liverpool	36	29	41	47
Llandrindod	13	..	..	
Maidstone Water Compy.	39	34	30	31
,, Public Conduit	36	28	25	27
Manchester	22	17	29	28
Newark	39	46	41	..
Newcastle-on-Tyne	37	40	43	68
Northampton	44	..	..	..
Norwich	36	49	*36	33
Nottingham	39	46	38	42
Oldham	23	..	..	..
Plymouth	29	..	..	28
Portsmouth	30	22	26	27
Reading	25	20	34	23
Rochdale	9	7	9	..
Rugby	41	..	..	46
Salford	18	14	21	21
Sevenoaks	20	..	..	..
Sheffield	22	..	..	..
Shrewsbury	23	..	17	19
Southampton	43	..	40	40
Stockport	17	..	..	..
Stourbridge	37	..	..	..
Stourport	37	..	..	..
Sunderland	25	27	..	..
Swansea	16	14	19	15
Tunbridge Wells	..	..	..	35
Warwick	34	34	..	10
Whitehaven	9	17	14	30
Wolverhampton	46	39	32	15
Worcester	55	..	..	..

* By a printer's error this was reported, last month, 56.

Taking the Metropolitan waters, we find that the average valuation of the supplies for September is about 3·5 higher than that for August, the valuation being now nearly 29·3. *This is, however,* lower by 1·8 than the average for the first six months of the year.

The most pure of the provincial supplies, during September, were Whitehaven, with a valuation of 10; Canterbury, 12; Swansea and Tunbridge Wells, 15 each; Bolton, 17; and Shrewsbury, 19; and in some, although not all, of these cases there is a slight improvement upon the August waters.

The following supplies also show an improvement upon the August waters, viz., Bradford, Brighton, Darlington, Leicester, and Wolverhampton.

On the other hand, the analyses of the following waters give less satisfactory indications, viz., Birmingham, Bristol, Edinburgh, King's Lynn, Liverpool, Maidstone, Newcastle, and Nottingham.

WATER ANALYSTS.

Special attention is drawn to the fact that it appears that some analysts have reported results of oxygen absorbed last month as relating to absorption in two minutes, instead of 15 minutes, as arranged under the new instructions. The Water Committee will be glad if the time of 15 minutes will be strictly attended to by analysts in future, and reports made as to the month in which the change was made.

COPYING INK FOR READILY TRANSCRIBING LETTERS WITHOUT A PRESS.

By Professor Attfield, F.R.S., &c.

The following paper was read at the York Meeting of the British Pharmaceutical Conference:—

The author stated that he had for the past 13 years used an ink which he copied into an ordinary thin-paper copying-book with no more effort than is employed in using a piece of blotting-paper, that is by simply pressing with the hand. This ready transcription is accomplished by using ink which dries slowly. The ink will of course be affected as to its drying by the weather, the absorbency of the paper on which it is written, by the thickness of the strokes, and so on; but practically the writer provides for these difficulties. Professor Attfield himself uses the ink from year's end to year's end without any trouble whatever. A firm of manufacturers had some time ago gone to the expense of provisionally patenting it in the hope that before the period of provisional protection elapsed it would be improved sufficiently to render it an ordinary commercial article. They had abandoned that hope, and so had the author. He now, however, offered the mode of making it to others for their own use, and possibly for druggists' sale. The principle of the method consists in dissolving a moderately powerful hygroscopic substance in an ordinary ink. After experimenting on various substances glycerine was found preferable. Reduce, by evaporation, ten volumes of ink to six; then add four volumes of glycerine. Or manufacture some ink of nearly double strength and add to any quantity of it nearly an equal volume of glycerine.

Nice Nourishment.—Any one thinking of spending the winter in Nice had better take all his provisions or an analyst with him, for, according to the *Pharmaceutische Zeitung*, July 29, 1881, of 850 analyses made in June of food and beverages sold there, no less than 559 were found to be seriously adulterated.

ANALYST'S REPORT.

Dr. Bernays, the professor of chemistry at St. Thomas's Hospital, and analyst to the Southwark District Board of Works, has just issued to that body the result of his analyses for the past year, in which he states that five samples of spirits analysed showed that with one exception the percentage of alcohol was up to and even beyond the legal standards. Two samples of cyder, one on draught and the other bottled, were both good of their kind. Neither of them contained a trace of metallic contamination, and both possessed a most pleasant odour of apples. The bottled cyder was preferable, in that it was less sweet and less liable to acescence. A non-alcoholic drink very much thought of at the present time, answering to the description of a tonic, was well aërated, and contained double its volume of carbonic acid, besides phosphorus in an oxidised form, and a notable quantity of iron. Speaking for himself, Dr. Bernays would prefer a glass of Burton ale, or, if he were an abstainer, a glass of water.

PURE OR ADULTERATED WINE.

The subject of wine adulteration continues to engage a great amount of attention both in Germany and France. In the former country, as most of our readers must doubtless be aware, more penal enactments have been recently passed with a view to the repression of anything in the shape of adulteration, and also to define with approximate clearness what is natural and what is artificial wine. Some difficulty appears to be experienced in establishing this definition. Chemists all over the world are very much alike, and those in Germany appear to be no less infallible in respect to analytical work than those in this country. There have recently been in Germany several prosecutions against wine merchants for the sale of adulterated wine, and many learned *savants* have given certificates of analysis to the effect that such wine ought not to be permitted to enter into consumption. These certificates have in many instances been called in question on behalf of the incriminated wine merchants, and rebutting evidence has not unfrequently shown that the analytical *ipse dixit* is practically entitled to not the least respect. The addition of water to wine has been the great cause of complaint, and with regard to the precise percentages of water added the German chemists have differed materially and egregiously erred. Their inaccuracies, of course, have been exposed in court, and it has been shown that they are more or less ignorant of the vinous properties naturally appertaining to wine, and those which an ingenious manipulator may have subsequently added on his own account. In France they manage things in a somewhat different fashion. The authorities there are determined to repress the adulteration of articles of food and drink—a very meritorious determination which, it is to be hoped, they will be able to successfully accomplish. They have established a municipal laboratory for the special analysis of suspected samples, and this seems to have given a great stimulus to the work of detecting adulteration. Numerous prosecutions of dealers have consequently been instituted, and special attention has been given to the wine trade. In reference to one of these prosecutions we notice that it was recently heard before the Eighth Chamber of the Tribunal of the Seine, the defendant being a wine merchant of Paris, who, in the reports is described as "M. D.," his full name not being given. He was charged with having sold a falsified wine, and from the evidence it transpired that he had been previously convicted of a similar offence. From the report of the chemist of the municipal laboratory the following facts are gleaned:—" M.D." who sold at 65 centimetres per litre a wine, the first cost of which was 73 centimes, added to this wine a certain quantity of water; his customers were distinctly informed of such addition, and a notice above his counter told the public that natural wine cost one franc per litre: This being the case, the defendant's advocate (M. Meurge) urged that no legal fraud had been committed; but the court sentenced the defendant to six days' imprisonment, a fine of 50 francs, and the cost of advertising the judgment. It must be noted that before any analysis of his wine had been made " M. D." had spontaneously admitted that he added 15 per cent. of water to it. The analysis of the municipal laberatory showed 9·20 of alcohol, and 18.50 dry extract, vinous elements which protect the merchant from prosecution, so that without the admission of " M. D." it is not probable that he would have been brought before Seine tribunal. Notice may also be taken of the negligence with which analyses appear to be conducted in the municipal laboratory. The report on this wine stated the existence of a foreign vegetable colourant, but without indicating its nature, and no information was given to the court with regard to the qualities of the wine. In consequence of these omissions, and in virtue of an analysis made by the able chemist of the Wine Trade Syndicate, the counsel employed by " M. D," asked that the wine should again b e analysed by some competent and reliable authority. This request, however, was somewhat unreasonably refused, which shows that French tribunals are not disposed to show any favour to people who are brought before them accused, rightly or wrongly, of adulteration.—*Grocer*.

LAW REPORTS.

Summons dismissed because taken out by person who had had the analysis made :—

A curious case was tried at Exeter recently. The Governors of the Devon and Exeter Hospital pay a large sum annually for milk, and they deem it of the highest importance that the milk supplied should be of the best quality, as it formed the chief food of children and typhoid fever patients in the Institution. An analysis was made, when it was found a great deal of the cream had been taken from the milk. When steps were being taken in connection with the analysis, the contractor wrote to the committee stating that if he had had more cows of his own, the cause of complaint would not have arisen, and he promised to get more, and supply milk only from these. He also pointed out that his family had been the contractors for thirty years. The Governors, however, decided to proceed against the contractor and he was summoned for having abstracted a certain portion of the milk, so as to injuriously affect its quality. A technical objection was taken that the prosecution was in the name of the person who had caused the analysis to be made; and the Bench ruling the objection to be good, dismissed the summons.

Milk Adulteration Cases :—

At the Thames Police Court, Henry Haveringham, of 26, Tapley Street, Bromley-by-Bow, was summoned under the Food and Drugs Act for selling adulterated milk. Evidence was given which showed that the public analyst of the district had found the sample submitted was adulterated with fourteen per cent. of water. The defendant said he put half a pint of water into a large quantity of milk. He was seventy-two years of age, and his wife seventy-four, and they were trying to earn a crust the best way they could. The magistrate said the defendant was cheating poor people who dealt with him, and fined him 20s. and 2s. costs.

Rebecca Bacon, of 145, Crisp Street, Bromley, similarly summoned, was fined £3 and 21s. costs.

Butterine Sold by an Assistant :—

At the Wednesbury Police Court, lately, Mr. Timothy Carter, grocer and provision dealer, Steelhouse Lane, Birmingham, was charged before Mr. F. F. Boughey (stipendiary), by Mr. Horder, the inspector under the Sale of Food and Drugs Act for the South Staffordshire district, with selling butter which was not of the quality and nature demanded by the purchaser. Mr. Stirk, of Wolverhampton, appeared for the defendant. Francis Henry Somerville, an assistant to Mr. Horder, stated that, on the 22nd ult., he visited a stall kept in the Wednesbury market by the defendant, and asked to be supplied with one pound of butter. An assistant supplied him with an article which he supposed to be genuine butter, for which he paid 8d. He informed the assistant that the article supplied him would be analysed by the county analyst (Mr. Jones), and if it were found to be adulterated, his employer would be summoned before the magistrate. Upon this the assistant stated that the article supplied was butterine. By Mr. Stirk: He was quite sure that he asked for butter. He was not told the article, before being supplied him, was butterine. It was after it was purchased that he was informed that it was butterine. In reply to Inspector Horder, witness stated that he had bought butter at 8d. per lb., which the analyst had certified to be pure. Mr. Horder stated that, on the 4th inst., he received two packets from the last witness, and he delivered one of them to the county analyst (Mr. Jones), who had since sent him a certificate to the effect that the article was not butter, and contained less than 1 per cent. of real butter fat. The analysis was: water 6·55, salt 1·32, curd 1·50, fat 90·53. Mr. Stirk said the article was not sold as butter, but as butterine; and as it was supplied by a young assistant, he trusted the Stipendiary would dismiss the case. The Stipendiary said he considered the case clearly proved, and as it was highly important that the public should be supplied with genuine articles, it was necessary that he, as a magistrate, should enforce the law. He considered the present case a bad one, and defendant would have to pay a fine of £5, and £1 14s. 6d. costs.

Coffee and Chicory Cases :—

At Clerkenwell Police Court, on September 9, Mr. Matthew Manns, grocer, of 270, Goswell Road, was summoned for having sold coffee adulterated with an admixture of chicory to the extent of 15 per cent. Inspector Eadds, inspector of nuisances, for the parish of St. Luke's, prosecuted. Four ounces of the coffee were purchased by a woman on August 5, at the instance of the inspector, and it was found to be adulterated in the way described. For the defence, it was said that it was usual in the defendant's shop to wrap mixtures of coffee and chicory in a paper on which was written notice to the effect that there was chicory admixed. Mr. Hannay imposed a penalty of 40s. and costs.

Mr. Henry Crocker, grocer, also of Coombs-street, St. Luke's, was fined 20s. for having sold coffee adulterated with 5 per cent. chicory.

Butterine Prosecution :—

At the Portsmouth Police Court, Mr. Wm. Lang, of Russell-street, Landport, was summoned for selling to the prejudice of the purchaser an article which was not of the nature, substance, and quality demanded. Mr. Feltham defended. Inspector Bell, one of the officers under the Food and Drugs Act, said that on August 24 he went in plain clothes to the defendant's shop, and saw some fatty substance in a tub, resembling butter, and marked 1s. per lb. Pointing to it, witness said, "Give me half a pound of that butter?" Defendant served him, and after the purchase had been completed, he said he was going to have it analysed by the public analyst. Thereupon the defendant remarked, "You did not ask for butter, you only said, 'Give me half a pound of that?'" The inspector, however, was positive upon the point. The certificate of the public analyst, Dr. Sykes, showed that the sample was entirely composed of foreign fat. In cross-examination, the inspector admitted that there were three tubs standing together. He asked for a half pound out of one of the end ones. The centre one was marked 10d. per lb., and on this tub was a printed card with "Butterine" in letters about three quarters of an inch in length. These other tubs were priced in the same way as the one from which he purchased a sample. Mr. Lance (one of the Bench): But is it possible to get butter at 1s. a lb.? The Inspector: Oh yes, sir, you can get very good butter at that price. Mr. Lance: Well, I should very much like to. Mr. Feltham, for the defence, said his client sold nothing else but butterine in the shop, and the fact that the centre tub of the three was labelled "Butterine" was, he contended, a sufficient protection for the defendant. His version of the story was that the inspector simply pointed to the tub, and said, "Give me a half a pound of that." As to the composition of butterine, Dr. Turner, the former medical officer of health, had said that butterine was more nutritious to the stomach than some kinds of butters. The magistrates, after consultation, said that, as there was a doubt in the case, the defendant would have the benefit of it, and be discharged.

RECENT CHEMICAL PATENTS.

The following specifications have been recently published, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

No.	Name of Patentee.	Title of Patent.	Price.
1880			
4245	J. C. Stevenson	Treatment of Ores of Lead and Zinc	4d.
5350	J. H. W. Biggs	Manufacture of Salt from Brine or other Solution ..	1/4
5372	Ditto	Manufacture of Salt for Domestic and other Purposes	2/6
1881			
225	St. G. L Fox	Electric Lamps	6d.
298	C. Scheibler..	Manufacture of Magnesia	4d.
331	Ditto	Manufacture of Sugar	4d.
375	A. Dupré & O. Hehner	Preparation of Banker's Cheques	4d.
386	W. R. Lake	Manufacture of Starch and Glucose or Grape Sugar..	10d.
422	W. Weldon	Treating Mixed Solutions of Chlorate of Lime and Chlorate of Calcium	4d.
423	Ditto	Manufacture of Chlorate of Potash	4d.
424 & 425	Ditto	Manufacture of Chlorate of Soda	4d.
546	J. A. Kendal	Manufacture of Dinitro Benzole	4d.
560	J. H. Johnson	Manufacture of Sugar	4d.
701	A. M. Clark	Manufacture of Magnesia	4d.
715	J. G. Tongue	Electric Lamps	2d.

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; Journal of Applied Science; The Boston Journal of Chemistry; The Provisioner; The Practitioner; New Remedies; Proceedings of the American Chemical Society; Le Practicien; The Inventors' Record; New York Public Health; The Scientific American; Society of Arts Journal; Sanitary Engineer of New York; The Cowkeeper and Dairyman's Journal; The Chemists' Journal; Oil and Drug News; The Textile Record of America; Sugar Cane; Country Brewers' Gazette; The Medical Record; Oil and Drug Journal; *Physiological and Therapeutic Properties* of Mineral Waters, by Dr. P. Killian.

THE ANALYST.

NOVEMBER, 1881.

SOCIETY OF PUBLIC ANALYSTS.

The next General Meeting of this Society will be held at Burlington House, on Wednesday, the 16th inst., at 8 o'clock.

ANALYSES OF GRAPE JUICES, AND OF VARIOUS SAMPLES OF UNFERMENTED AND OTHER WINES.

By J. Carter Bell.

My reason for these investigations was that the Salford inspector brought me some samples labelled "Pure Grape Juice," "Unfermented Wine," "Sacramental Wine," &c., &c., some of which I suspected were not genuine, and as I was unable to find any recent reliable data as to what grape juice really is, I determined to ascertain for myself; I therefore bought several samples of grapes and squeezed the juice from them myself. Other samples I obtained from Mr. Frank Wright, of London, who is well known in the temperance world as a maker of pure unfermented wines. He imports large quantities of grapes from which he presses the juice; some of the grapes were squeezed by him in my presence.

The following list gives the names of the pure grape juices operated on:—

1. Black English hot-house grapes.
2. White English hot-house grapes.
3. Almeira, 1879.

} Purchased in England, and juice expressed by myself.

4. Do., 1880.
5. French Cluster, 1878. Chiefly used in the production of "Vin Ordinaire."
6. Portuguese Cluster, 1879. Purchased in England, and juice expressed in my presence.
7. Bordeaux, 1880. A mixed must, consisting of Carbenet Sauvignion, Malbec and Verdat Varieties.
8. Oporto, 1880. "The Bastardo," from the Alta Douro.
9. Pineau. (The Champagne grape). From the Cot d'or.
10. Folly Blanc. (Cognac grape).
11. Blanquette.
12. Grenach, No. 1.
13. Grenach, No. 2.

} From the vineyards of Perpignan.

14. Granache.
15. Clairette.

} From a vineyard in the vicinity of Tarragona.

16. Congress. From vineland, New Jersey, U.S.
17. Madeira Videilho.
18. Madeira Tinta.

The following table gives the specific gravity; also the total acidity calculated as tartaric acid, and the ash from 100 c.c., and the percentage of ash which is soluble and insoluble in water; all results in percentages:—

No.	Specific Gravity.	Acid.	Ash.	Ash Soluble.	Ash Insoluble.	
1	1083	·70	·356	90·56	9·43	
2	1071	·60	·331	89·42	10·57	
3	1071	·60	·311	84·40	15·59	
4	1056	·70	·258	78·57	21·43	
5	1058	1·17	·273	76·32	23·68	
6	1078	·39	·252	88·09	11·91	
7	1079	·97	·298	56·65	43·34	
8	1088	·67	·261	72·79	27·20	
9	1065	1·12	·289	70·24	29·76	
10	1077	·75	·266	70·88	29·11	
11	1100	·60	·284	72·12	27·88	
12	1084	·75	·291	68·77	31·22	
13	1076	1·61	·289	63·51	36·48	These samples had undergone some fermentation, and contained a considerable quantity of vol. acid.
14	1096	1·50	·305	67·41	32·59	
15	1102	·90	·348	63·95	36·05	
16	1070	·75	·395	74·74	25·26	
17	1107	·75	·267	59·27	40·73	
18	1101	·60	·318	63·99	36·00	

All the above samples, except 13 and 14, were unfermented. Fermentation had been arrested by the addition of salicylic acid, or by raising the juice immediately upon expression to the boiling temperature. The last thirteen musts in this list were pressed on their respective vineyards. They were not submitted to analysis until six months after their arrival in this country. Samples Nos. 4, 7, 8, 14, 15 and 16, had deposited varying quantities of potass bitartrate in the stock vessels. In these cases the acidity, total ash, and soluble ash given in the above tables are therefore somewhat below what would have been yielded by freshly expressed and filtered juices.

On comparing these results it will be observed that in no sample examined was there a total absence of those inorganic constituents which are frequently regarded as essential to the constitution of the grape. The variations in their proportions is, however, most striking. Confining to the proportions of total, and of soluble and insoluble ash, it will be seen that the total ash ranges between ·258 per cent. and ·395 per cent.; and it is remarkable that each of these extremes was furnished by a juice which had stood in the stock vessels for several months, and had undoubtedly deposited a considerable quantity of its mineral constituents. The extreme of variation in the proportion of soluble ash is 56·65 to 90·56 per cent. of the total ash; and of the insoluble ash the variations are from 9·44 to 43·34 per cent. of the total ash. These variations, when viewed from the point of view of the professional analyst, are instructive in two or three particulars. It is obvious that in attempting to determine whether a particular sample is or is not pure juice of the grape regard must be had both to the species of grape and to the time when the juice was expressed, whether old or recent. The consideration of age would not, however, apply in the case of a sample of which it is admitted that it contains a large admixture of water, as in the case tried at Salford. In that case it was admitted by the defence that the sample consisted of one-fifth grape juice, and four-fifths water. Such a mixture does not deposit the

salts of the grape, but only some light flocculi which contain merely infinitesimal quantities of inorganic constituents.

Table giving the number of grains of chief constituents of ash from one gallon of grape juice from each of the above samples :—

No.	Total Ash.	Potash.	Soda.	Chlorine.	Sulphuric Acid.	Phosphoric Acid in combination with Alkalies.	Lime.	Magnesia.	Phosphate Iron.	Alumina Phosph.	Phosphate of Lime.	Silica.
1	249·20	135·21	8·71	1·31	26·21	18·16	1·62	2·41	·12	·21	18·12	·21
2	231·70	119·31	7·61	2·00	23·14	10·12	1·82	3·01	·20	·12	22·35	·20
3	218·12	108·3	9·70	1·47	25·34	13·56	2·10	3·75	·14	·35	25·00	·70
4	181·16	88·16	3·58	·65	18·42	10·50	6·19	4·25	·18	·45	18·91	·60
5	191·03	92·52	0·56	1·20	22·48	4·21	4·04	3·89	1·48	·98	30·52	·31
6	176·33	88·96	2·95	2·80	19·71	10·12	3·48	3·87	1·88	·77	10·50	·28
7	205·10	69·55	2·40	3·10	14·70	12·06	12·11	8·76	·47	·75	49·76	·17
8	182·70	74·62	10·01	1·70	13·37	1·12	13·21	9·31	·68	1·90	10·43	·63
9	202·30	87·64	2·07	2·07	14·26	7·06	12·55	3·25	2·64	1·35	32·50	·35
10	186·20	76·72	1·15	·71	9·86	·42	26·60	8·40	1·96	2·24	9·24	·30
11	219·24	94·15	3·62	1·65	16·34	11·40	11·20	10·80	1·23	1·54	35·00	·15
12	203·56	79·00	6·21	2·03	16·02	4·58	11·20	17·36	1·12	1·68	26·88	·40
13	202·38	71·40	4·34	3·57	18·43	3·64	12·32	22·68	3·40	3·71	30·24	·84
14	213·92	81·76	7·50	3·20	23·62	2·99	10·00	9·22	1·12	·84	49·00	1·19
15	243·90	97·35	5·43	3·05	24·48	1·25	13·16	31·36	4·20	6·44	21·56	2·46
16	241·85	107·20	20·62	1·01	10·65	17·02	10·71	7·00	·94	·63	17·32	·70
17	186·90	59·60	3·34	1·04	25·56	1·59	10·64	18·69	·70	1·22	37·61	1·22
18	222·60	80·95	9·10	2·36	20·78	2·52	7·95	11·94	1·29	·98	48·01	·87

Chief constituents in 100 parts of ash, calculated in percentages on the total ash :—

No.	Potash.	Soda.	Chlorine.	Sulphuric Acid.	Phosphoric Acid with Alkalies.	Lime.	Magnesia.	Iron Phosphate.	Alumina Phosphate.	Lime Phosphate.	Silica.
1	54·235	3·493	·525	10·513	7·284	·650	·966	·048	.084	7·268	·084
2	51·434	3·051	·862	9·975	4·362	·784	1·297	·086	·051	9·635	·086
3	49·646	10·539	·673	11·614	6·219	·962	1·720	·064	·160	11·424	·320
4	48·660	1·979	·363	10·170	3·038	3·418	2·349	·104	·251	10·444	·332
5	48·413	·293	·626	11·766	2·198	2·113	2·036	·776	·512	15·970	·164
6	50·086	1·663	1·587	11·179	3·445	1·958	2·179	1·052	·433	5·911	·157
7	33·170	1·148	3·390	7·189	5·756	5·410	4·178	·225	·359	23·73	·131
8	39·980	5·360	·927	7·319	·596	7·080	4·990	.364	1·020	5·57	·337
9	42·418	1·003	1·026	7·051	3·419	6·078	1·573	1·227	·653	15·72	·169
10	40·354	·607	·383	5·294	·219	13·991	4·418	1·030	1·178	4·860	·162
11	46·426	1·784	·828	8·221	5·623	5·521	5·324	·606	·760	17·255	·076
12	38·789	2·910	1·001	7·868	2·160	5·260	8·180	·526	·789	12·640	·189
13	34·557	2·100	1·760	9·112	1·762	5·962	10·977	1·640	1·795	14·636	·406
14	37·527	7·344	1·501	11·062	1·377	4·590	4·231	·514	3·850	22·491	·546
15	39·039	2·180	1·251	10·040	·503	5·277	12·575	1·684	2·582	8·645	·988
16	37·948	7·292	·292	3·137	6·026	3·791	4·980	·332	·220	3·131	·248
17	31·233	1·750	·559	13·678	·832	5·575	9·793	·367	·642	19·710	·641
18	35·620	6·283	1·060	9·336	1·112	3·498	5·253	·567	·431	21·124	·385

The following are samples of unfermented and other wines brought and obtained from various places :—

No. 1.—Label on bottle : " Bell's unfermented juice of the vine, pure uncoloured virgin wine, nutriment of the grape without the irritant."

" Unfermented wine, sherry, manufactured from the juice of the grape."

"Unfermented wine, port, manufactured from the juice of the grape."

Comparing the analyses of the ashes of the above three "Wines," as given in the succeeding tables, with the ash from pure grape juice, there will be no difficulty in deciding that these three samples are not genuine grape juice.

No. 4.—" ——— new wine," stated on the label to be "the best unfermented wine introduced, the guaranteed fruit of the vine, free from alcohol." This wine contained 1½ per cent. of proof spirit ; it also gave a very low ash.

No. 5.—" Purest unfermented wine for the administration of the Lord's Supper, carefully bottled by ———. The selected wine of the temperance fraternity." This wine is alleged to be unfermented, and to consist of the juice of the grape boiled down to one-fifth of its original bulk in order to deprive it of its spirit. The low specific gravity and the proportion of ash prove that it has not been boiled down. The presence of 30 per cent. of proof spirit also stands as a witness to prove the absence of boiling.

No. 6.—" Pure and genuine unfermented fruit of the wine; ———." This wine contained 2½ per cent. of proof spirit.

No. 7: "Castle Tent, bottled and guaranteed by ———." The label represents this to be an unfermented sweet wine, with only the small amount of spirit necessary for its preservation. This wine contained 14 per cent. of proof spirit.

No. 8.—Castle Rota Tent. This is similar to No. 7.

No. 9.—" Unfermented wine, free from alcohol and unintoxicating, preserved *in vacuo* by ———. This wine is prepared from grapes, specially imported from Andalusia, Burgundy and the Medoc, for this purpose; it is guaranteed to be the true fruit of the vine." This sample was bought from a shop in the Borough of Salford by the Salford inspector. It did not contain alcohol, and the analysis of the ash is similar to the analysis of pure grape juice ash.

No. 10.—Greek wine from the Island of Scio, "unfermented."

No. 11.—White grape wine, fermented, from the Island of Scio.

No. 12.—Deidesheimer, pale alcoholic wine.

No. 13.—Diedesheimer Aucolee, a pale alcoholic wine.

No. 14.—Italian juice, from Palmi, Calabria.

Specific gravity of the wines; also the total acidity calculated as tartaric acid, and the ash from 100 cc., and the percentage of ash which is soluble and insoluble in water :—

No.	Specific Gravity.	Acid.	Ash.	Ash Soluble.	Ash Insoluble.
1	1100	·67	·033	30·30	69·69
2	1004	·61	·030	33·33	66·66
3	1107	·59	·034	38·23	61·76
4	1087	·56	·190	76·84	23·15
5	1015	·37	·261	69·77	30·27
6	1071	1·125	·342	61·40	38·50
7	1125	·75	·593	75·00	24·96
8	1158	·75	·570	69·80	30·17
9	1078	·67	·290	74·48	25·52
10	1047	·72	·368	75·80	24·20
11	990	·71	·158	70·58	29·41
12	995	·84	·185	62·59	37·45
13	996	·60	·194	54·54	45·41
14	1096	·73	·347	74·94	25·06

Table giving the number of grains of chief constituents of ash from one gallon of wine :—

No.	Potash.	Soda.	Chlorine.	Phosphoric Acid united to Alkalies.	Sulphuric Acid.	Lime.	Magnesia.	Iron Phosphate.	Alumina Phosphate.	Lime Phosphate.	Silica.	Oxide of Copper.
1	5·04	2·30	·14	·104	9·00	1·734	·216	·190	·482	2·219	·434	·864
2	1·97	2·31	·14	·104	8·56	1·596	·378	·240	·474	2·303	·476	·945
3	3·30	1·67	·14	·228	9·40	1·05	·67	·29	·942	3·696	·560	·945
4	58·10	4·55	2·80	4·27	8·542	9·80	7·77	2·25	·690	1·120	1·12	..
5	64·89	11·12	9·80	7·12	30·710	14·49	9·839	·60	1·850	10·92	·875	..
6	89·11	5·10	4·34	7·12	26·60	25·90	17·516	..	2·980	·77	·84	..
7	148·62	10·69	18·20	20·809	83·51	17·22	18·014	2·83	5·570	39·55	1·12	..
8	135·24	17·94	29·12	21·985	68·88	15·40	16·187	2·83	5·430	53·90	1·61	..
9	93·92	1·50	1·32	5·210	23·12	5·52	4·21	1·51	1·000	33·67	·40	..
10	85·05	23·38	18·54	41·37	16·08	7·175	16·60	1·283	1·960	23·49	·28	..
11	47·32	5·62	1·359	8·43	12·68	3·191	3·53	·491	·418	11·928	1·106	..
12	61·81	1·20	2·128	5·884	15·827	3·693	3·822	·945	1·260	23·975	·735	..
13	50·12	2·13	2·786	10·405	11·216	7·977	5·083	·641	·933	21·305	·105	..
14	126·70	3·01	3·547	30·141	16·613	9·035	5·976	2·401	2·429	28·385	1·365	..

Chief constituents in 100 parts of ash :—

No.	Potash.	Soda.	Chlorine.	Sulphuric Acid.	Phosphoric Acid.	Lime.	Magnesia.	Iron Phosphate.	Alumina Phosphate.	Lime Phosphate.	Silica.	Copper Oxide.
1	21·808	9·952	·605	38·943	·450	7·503	·934	·822	2·085	9·601	1·877	3·651
2	9·401	11·024	·666	40·683	·495	7·597	1·800	1·142	2·216	10·962	2·265	4·508
3	13·876	7·030	·588	39·513	·957	4·410	2·814	1·218	3·956	15·523	2·352	3·969
4	43·663	3·419	2·104	6·419	3·208	7·364	5·845	1·690	·518	·841	·841	..
5	35·501	6·083	5·361	16·801	3·900	7·917	5·383	·328	1·002	5·974	·478	..
6	37·203	2·129	1·812	11·105	2·970	10·813	7·313	..	1·244	·321	·350	..
7	35·887	2·576	4·382	20·109	·676	4·346	1·095	·681	1·341	9·523	·270	..
8	33·877	4·594	7·394	17·254	5·507	3·857	4·054	·708	1·360	13·501	·403	..
9	46·246	·738	·650	11·384	2·565	2·718	2·072	·743	·492	16·579	·196	..
10	31·233	1·750	6·770	13·678	·832	5·575	9·793	·366	·642	19·710	·641	..
11	42·763	5·080	1·228	11·467	7·617	2·883	3·196	·443	·377	10·779	·999	..
12	47·655	·925	·162	12·197	4·533	2·847	2·946	·728	·971	18·484	·566	..
13	36·888	1·567	2·044	8·250	7·654	5·865	3·738	·471	·684	15·680	·077	..
14	52·073	1·237	1·455	12·387	6·826	3·713	2·456	·986	·998	11·664	·561	..

In several instances the quantity of liquor at my disposal was very small, thus preventing me from making duplicate analyses.

ANALYSES OF LIEBIG'S EXTRACT OF MEAT, AND OF AN IMITATION OF THE EXTRACT.

By C. Estcourt, F.I.C., F.C.S.

A few months ago I received a sample pot, duly labelled, &c., purporting to contain the genuine Extractum Carnis Liebig, which I was informed had been imported into this country from Italy. I was also informed upon good authority that the imitation was made principally from horse flesh, that it had been offered at a slightly reduced price, and had been purchased in considerable quantities by one or two large establishments in the city of Manchester.

Being of opinion that the comparative analyses of both the genuine and the imitation might be of some value to Public Analysts in other towns where the article was offered, I obtained from a large firm of wholesale druggists here, a sample of undoubtedly genuine

Liebig's Extract to compare with the imitation. The latter in general get-up, labels, signature, and every detail would inevitably deceive anyone who merely judged by the appearance of the article.

	PER-CENTAGE COMPOSITION.	
	Imitation.	Genuine.
Total Solid Matter	82·0	88·0
Water	18·0	12·0
Fat	1·0	0·0
Total Ash	23·10	21·31
Ash Insoluble in Water	1·32	1·48
Sodium Chloride	14·21	8·12
P_2O_5 Phosphoric Anhydride, in Soluble Phosphates	1·765	4·627
HSO_4 Sulphuric Acid, in Soluble Sulphates	0·451	0.606
Akalinity of Soluble Ash, expressed as NaHO	2·401	2·160

It will be observed that the main differences between these two samples are due to the excess of NaCl and the deficiency in Phosphoric, which, together with the presence of fat, characterise the imitation sample.

NOTE ON WILLIAMS'S NITROGEN PROCESS.

By Thos. P. Blunt.

Williams's zinc couple method may be conveniently and accurately worked without distillation, in the case of any water, by adding oxalic acid to a double quantity of the sample, dividing, and using one portion, simply cleaned by subsidence in a stoppered bottle, as a comparison liquid for testing against the other, treated with the zinc couple in the usual manner. Of course, where dilution is used it must be carried out on each portion. The advantages of this modification are two-fold—(1) an equal turbidity is produced by Nessler solution in both samples, and (2) where the oxalic acid has contracted traces of ammonia, as is so often the case in a laboratory, the error introduced is corrected.

QUALITATIVE ANALYSIS OF A SOLUTION OF "CITRATE OF MAGNESIA," SOLD BY A NEW YORK MANUFACTURER.

By Edo Claassen, Cleveland.

Having found it difficult to prepare a solution of citrate of magnesia that will remain clear and not precipitate, and further, that the solution of citrate of magnesia sold by a certain firm always possesses these properties, I undertook some time ago to examine the same in regard to the presence of magnesia and citric acid. The usual analytical method of destroying by evaporation and subsequent ignition all organic substances, in order to determine the fixed bases, was employed by me in this case. I, therefore, evaporated about 4 oz. of the liquid in a silver dish to dryness, ignited the residue perfectly, and mixed the same with water and as much hydrochloric acid as was necessary to give the solution an acid reaction. The solution was then separated from a small quantity of coke, and a part of it was mixed with ammonia in excess, and with solutions of ammonium chloride and sodium phosphate. No precipitate was formed, not even after several hours' *standing*. Magnesia was not present. The rest of the liquid was then tested for the

presence of potassium and sodium, and only the last one found present. Another part of the original so-called "citrate-of-magnesia solution" was now tested in regard to the acids that might be combined with the sodium, and it was ascertained that, besides a little sulphuric acid, no other acid besides tartaric was in the liquid. The so-called solution of "citrate of magnesia" was, therefore, nothing but a solution of sodium tartrate, and it could now at once be explained why this solution always keeps well, and never forms a deposit.—*New Remedies.*

ON THE PURITY OF COMMERCIAL IODIDE OF POTASSIUM.

By O. Kaspar.

The method which is employed by the author to determine the per-centage of pure iodide is very simple, and has the additional advantage that it is not interfered with by the presence of carbonate, bromide and chloride. It depends upon the following reaction:—

$$HgCl_2+4KI = 2KCl+HgI_2.2KI.$$

Four molecules of iodide of potassium are, therefore, exactly decomposed by 1 molecule of corrosive sublimate, so as to form a soluble double salt. If, now, an excess of corrosive sublimate is added, the double salt is again decomposed and mercuric iodide is separated.

$$HgCl_2+HgI_2.2KI = 2KCl+2HgI_2.$$

As soon as this separation begins, the reaction is terminated.

The normal solution of corrosive sublimate is prepared by dissolving 2·71 grams of the salt in sufficient water and diluting to 100 cubic centimetres. 1 cc. of the solution, according to the above equation, indicates 0·06643 gram of iodide of potassium. When using the process, 10 grams of the iodide of potassium are dissolved in 50 grams of water, and 5 cubic centimetres of this solution are used at a time for trituration. This quantity is run into a beaker, placed on a sheet of white paper, and the above volumetric solution is allowed to flow in from a burette divided in $\frac{1}{10}$, until a permanent reddish yellow opalescence ensues. Just before this occurs, the liquid itself assumes a reddish-yellow colour, which may be regarded as a sign of the approaching end of the reaction. It is best to prepare the solution of the sublimate each time fresh.

The author has examined many commercial samples of iodide of potassium by this method and has found the per-centage of the true salt to vary between 88 and 99·6 per cent. He considers that the commercial salt should contain *at least* 96 to 97 per cent. of pure salt.—*Schweiz. Woch. f. Pharm.*

LEAD IN BROMIDE OF POTASSIUM.

Maschke has found bromide of potassium in the market which is contaminated with lead. It is soluble to a clear liquid only after addition of an acid; the larger crystals are remarkable by their transparency and their form, being a compound of octoëders and cubes. In testing for lead, sulphuric acid cannot be used, since the resulting sulphate of lead is soluble in bromide of potassium. But if hydrosulphuric acid or sulphide of ammonium is used, no doubt can arise.—*Pharm. Zeit.*

THE ADULTERATION OF BALSAM OF PERU.

By Alfred Senior, M.D., F.C.S.

The adulteration of balsam of Peru has been practised to a large extent and with some degree of success, for several years past, principally in the north of Germany. The adulterants employed are rosin, gum benzoin liquefied with a little alcohol, storax, copaiba, and in some cases castor oil. In a communication to the *Pharmaceutische Zeitung* (xxx., 222,) Prof. Flückiger deals with the problem of the examination of Peru Balsam for impurities. Pure balsam of Peru is a mixture of about two-thirds, as a maximum, of benzyl cinnamate or cinnameni, and one-third, as a minimum, of a brownish black resin; it also contains about four per cent. of cinnamic acid, besides small quantities of other substances. The specific gravity determined at 15° C. varies from 1·138 (minimum) to 1·147 (maximum), and inasmuch as all the adulterants are lighter than the pure balsam, the specific gravity of the sample is an important item. Samples should be regarded with suspicion when the specific gravity is below 1·14, or perhaps as the extreme limit, 1,138. Among other physical characteristics, the consistency of the specimen is important; adulterated samples usually yield "thick, thread-like attenuated drops."

The benzyllic cinnamate is easily extracted from the balsam by shaking with three times its weight of carbon disulphide, the solution, which, if the balsam be pure, is nearly colourless, being evaporated and the residue weighed. The quantitative determination of this constituent is not always of much value, owing to the varying amount of this substance contained in different specimens of balsam: in some cases, however, it is valuable, the effect of adulterants being to increase the weight of what ought to be nearly pure benzyllic cinnamate. The substance remaining after the treatment with carbon disulphide is the rosin, the weight of which should be nearly two-fifths, or at any rate exceed one-third, of the original weight of the balsam operated upon. If adulterants have been added, the weight will be less than this. For the estimation of the cinnamic acid, the author proposes the following method: fifty parts of balsam are boiled with a mixture of twenty parts of lime and five hundred parts of water, for two hours, care being taken to replace any water which evaporates during the process. At the end of this time the boiling solution is filtered, the substance remaining on the filter being twice washed with two successive two hundred parts of boiling water. In this way all the cinnamic acid is obtained in solution as calcium cinnamate. The filtrate and washings are now evaporated to two hundred parts, treated with excess of hydrochloric acid and allowed to stand for some time. The cinnamic acid which will have separated in crystals, is collected, and after pressing between bibulous paper, dried partially by exposure to the air and finally on the water-bath. The weight ought to equal from three to four per cent. of the original sample. The determination of this constituent, however, is only of importance when considered in relation to the amounts of the other substances present. After the above treatment there remains upon the filter a mixture, the condition of which affords an important indication of the purity of the balsam—pure samples yield a "soft, pliable mass;" when adulterated the mass is more or less hard. So important does Prof. Flückiger consider this indication that he proposes a special test based upon it, for the determination of the general purity of balsam of Peru. If two parts of the balsam are triturated with one part of slacked lime a "soft, kneadable *or somewhat* pliable, tenderly divisible mass" is obtained if the balsam is pure; in fact

the mass presents exactly the characteristics that one would expect from such a mixture. Where, however, storax, alcoholic extract of gum benzoin, rosin or copaiba were added to the extent of ten per cent., the mass became solid, hard and unkneadable. If this test is found by other experimenters to answer with all genuine specimens of balsam of Peru, Prof. Flückiger suggests that as a test of purity, it should be ordered that "ten drops of Peru balsam shall furnish with four grammes of slacked lime a mixture which remains soft." The only case where this test could not be applied is when castor or other fatty oils have been used as adulterants. These substances, however, would be revealed by heating the lime mixture, when they would be rendered evident by their odour and would also be detected by the treatment with carbon disulphide.

GERMLESS MAIZE.

The importance of maize to the distiller and to the brewer is becoming generally recognised in this country, but it requires to be degerminated to be used to the highest advantage. The removal of the germ greatly enhances the value of the maize for the purposes of the distiller, and the degerminating process promises to be exceedingly valuable as a means of preparing the grain in question. By degermination its value is increased, by increasing the proportion of starch, so as to yield, it is said, 5·26 lbs. more of proof spirit for every 100 lb. of maize employed. By the reduction of the proportion of oil to something like that contained in barley malt, and by reducing to some extent the amount of nitrogenous compounds, the spirit from germless maize is, it is found, not only larger in quantity, but better in quality than that from the whole grain, while the extracted germs, though detrimental in distilling, are, it is said, more valuable for feeding purposes than the article in a whole state. The germs contain a larger amount of oil than linseed cake, while the nitrogenous matter, so valuable as a flesh-former, is largely increased by the degerminating process. Messrs. Muir and Son are said to be working the process upon a large scale, and to the entire satisfaction of distillers, brewers, and starch makers, who are their largest customers. As an article of feed for horses, when reduced with hay, chaff, or straw, the germ, as extracted by the process of the Messrs. Muir, we understand, commands a high price, ratifying the statement made by Mr. Gladstone in his budget speech respecting the enhanced value of the cereal in its degermed state for distilling, brewing, starch-making, and for feeding purposes. Distillers as a class are not less alive to their interests than any other class of manufacturers, and there may be a good future in store for the Muir process. —*Miller.*

Displacement of the Sodium Base in Sodium Chloride by Copper Hydrate.—Copper hydrate in a moist state possesses the singular property of liberating a certain quantity of alkali, if it is brought in contact with certain saline solutions, such as sodium and potassium chloride, potassium bromide, sodium sulphate, &c. The displacement of the alkali takes place even at temperatures as low as 4° and 5° C. If copper hydrate, well washed and moist, is added to a solution of sodium chloride of 10 per cent., the liquid in a few minutes acquires an alkaline reaction, which increases on standing. Meantime the hydrate is converted into a pale green powder containing chlorine. Moist copper carbonate acts in a similar manner.—*Comptes Rend.*

SOCIETY OF PUBLIC ANALYSTS.

Analyses of English Public Water Supplies in October, 1881. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Date when drawn.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine in Chlorides.	Phosphoric Acid in Phosphates.	Nitrogen in Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in 15 mins. at 80° Fahr.	Oxygen, Absorbed in 4 hours at 80° Fahr.	Hardness, Clark's Scale, in degrees. Before Boiling.	Hardness, Clark's Scale, in degrees. After Boiling.	Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
Kent Co.	Oct. 11	pale blue green	none	1·91	trace	·255	·0029	·0078	none	.0080	22·0°	6·4°	31·80	satisfactory	Wigner & Harland.
New River	,, 15	clear	none	1·14	trace	·210	·0021	·0028	·0120	·0260	15·0°	15·0°	18·76	satisfactory	B. Dyer.
East London ..	,, 11	p. g. yel. s. turb.	none	1·49	trace	·199	·0026	·0067	none	·0840	14·9°	5·3°	23·20	vegetable debris	Wigner & Harland.
Southwark & Vauxhall ..	,, 8	c. v. p. yellow	none	1·24	trace	·150	none	·0042	·0300	·0560	14·5°	3·5°	20·10	satisfactory	J. Muter.
West Middlesex	,, 18	yellow green	none	1·17	trace	·138	·0020	·0056	·0330	·0620	13·1°	2·4°	19·35	satisfactory	O. Hehner.
Grand Junction	,,	pale yellow	none	1·22	trace	·161	·0010	·0069	·0031	·0840	14·1°	3·9°	20·00	satisfactory	A. Wynter-Blyth.
Lambeth	,, 8	c. v. p. yellow.	none	1·49	trace	·160	none	·0042	·0308	·0561	14·5°	3·5°	20·16	satisfactory	J. Muter.
Chelsea	,, 12	c. p. grnsh. brn.	none	1·16	trace	·140	·0010	·0080	·0320	·0780	13.5°	2·5°	19·01	satisfactory	A. Dupré.
Bath	Oct. 14	clear f. blue	none	1·08	none	·150	none	·0001	none	none	17·5°	4·5°	22·72	none	J. W. Gatehouse.
Bradford	,, 19	s. opq. pty. yell.	none	·60	none	none	none	·0049	·0200	·1460	4·2°	3·9°	7·80		F. M. Rimmington.
Birmingham ..	,, 4	v. turb. grsh. yel.	none	1·19	trace	·092	·0020		·0140	·1550	9·1°	5·5°	17·25	siliceous and veg. matter	A. Hill.
Bolton........	,, 10	v. turbid yellow	none	·45	none	·032	·0019	·0056	·0285	·0485	3·2°	3·0°	6·30	clayey subs. & veg. mtter.	W. H. Watson.
Brighton......	,, 11	pale blue green	none	2·06	none	·385	·0011	·0043	none	none	12·6°	4·0°	23·80	vegetable debris	Wigner & Harland.
Bristol........	,, 10	greenish	none	·90	none	·055	·0010	·0063	·0148	·0468	7·7°	2·2°	16·80	algæ & sand	F. W. Stoddart.
Bury (Lan.) ..	,, 8	s. turbid yellow	s. mossy	·90	none	·042	·0040	·0095	·0188	·0324	4·5°	4·4°	8·63	mineral matter veg. deb.	W. H. Watson.
Cambridge	,, 15	c. pale blue	none	1·40	traces	·411	none	·0016	·0044	·0131	17·5°	6·0°	24·50	satisfactory	J. West Knights.
Canterbury	,, 17	pale blue	none	1·47	none	·338	·0006	·0005	·0040	·0120	5·2°	4·2°	9·24	slight	S. Harvey.
Croydon	,, 20	f. green	none	1·05	trace	·324	·0030	·0020	·0072	·0072	16·0°	7·5°	22·60	none	C. Heisch.
Darlington	,, 14	s. turb. yel. grn.	s. peaty	·56	traces	none	none	·0098	·0153	·2520	6·4°	3·0°	8·96	movg. orgnsms. min. mtr.	W. F. K. Stock.
Edinburgh	,, 11	yellowish	none	·67	none	trace	·0032	·0072	·0160	·1184	4·7°	3·9°	6·40	none	J. Falconer King.
Exeter	Sept. 23	f. brnsh. yellow	none	·84	trace	·077	·0007	·0039		·0483	2·8°	2·8°	7·00		F. P. Perkins.
Grantham	Oct. 16	l. brown opaque	slight	·99	trace	·438	·0015	·0115	·0684	·1177	14·0°	5·0°	23·10	diat., conferv., vortic., &c.	A. Ashby.
Hastings	,, 17	pale blue cloudy	none	5·30	trace	·190	·0042	·0035	·0014	·0084	6·0°	3·5°	22·20	none	H. F. Cheshire
Ipswich	,, 12	c. colourless	none	2·12	trace	·395	·0026	·0044	none	·0080	24·0°	4·5°	34·62	satisfactory	J. Napier.
King's Lynn ..	,, 17	light brown	weedy	1·49	traces	·082	·0005	·0070	·0268	·3002	10·8°	4·5°	18·90	animalculæ veg. debris	W. Johnstone.
Leamington ..	,, 13	greenish	none	1·47	none	none	·0028	·0014	none	none	27.8°	14·0°	30·80	vegetable matter	A. Bostock Hill.

SOCIETY OF PUBLIC ANALYSTS.

Analyses of English Public Water Supplies in October, 1881. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Date when drawn.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine in Chlorides.	Phosphoric Acid in Phosphates.	Nitrogen in Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in 15 mins. at 80° Fahr.	Oxygen, Absorbed in 4 hours at 80° Fahr.	Hardness, Clark's Scale, in degrees. Before Boiling.	Hardness, Clark's Scale, in degrees. After Boiling.	Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
Leicester......	Oct. 20	s. yellow	none	1·12	traces	·075	·0011	·0023	·0030	·0730	7·7°	5·4°	16·33	vegetable debris	W. L. Emmerson.
Liverpool	,, 13	yellow brown	s. peaty	1·08	traces	·077	·0028	·0056	·0462	·0691	5·3°	4·7°	8·40	amorphous matter	A. Smetham.
Maidstone—															
Wtr. Company	,, 13	yell. grn. s. turb.	none	2·33	traces	·860	none	·0014	·0260	·0364	17·9°	6·6°	33·60	satisfactory	M. A. Adams.
Public Conduit	,, 13	c. colourless	none	2·14	traces	·860	none	·0003	·0056	·0156	17·5°	6·2°	32·13	satisfactory	M. A. Adams.
Manchester....	,, 19	s. turb. f. yellw.	none	·73	none	none	·0031	·0065	·0431	·1835	2·0°	2·0°	4·84	s. mineral	W. Thomson.
Newark	,, 14	turbid, greenish	none	1·43	trace	·055	·0009	·0039	·0191	·0455	17·0°	9·0°	35·81	amorphous matter	A. Ashly.
Newcastle-on-Tyne......	,, 10	f. yellow	none	·76	trace	·040	trace	·0090	·0770	·1220	16·0°	5·0°	18·90	satisfactory	J. Pattinson.
Norwich	,, 8	p. grnsh. yellow	none	1·90	traces	·049	traces	·0060	·0366	·0680	13·0°	4·2°	16·40	satisfactory	W. G. Crook.
Nottingham ..	,, 14	p. blue green	none	2·76	none	1·840	none	·0070	none	·0100	17·6°	12·6°	38·40	veget. deb. earth anim.	Wigner & Harland
Portsmouth ..	,,	s. turbid	none	1·12	trace	·190	trace	·0031	none	none	13·8°	2·0°	19·50	decayed veg. diatoms	W. J. Sykes.
Reading	,, 4	f. yellow	none	1·10	trace	·155	·0007	·0049	·0030	·0560	15·1°	4·7°	19·20	satisfactory	J. Shea.
Rochdale	,, 17	v. f. green	none	·60	none	none	·0007	·0014	·0007	none	2·2°	2·0°	3·20	satisfactory	T. A. Collinge.
Rugby	,, 1	f. turb. colourless	none	1·42	v. h. traces	·092	·0017	·0168	·0337	·0840	20·0°	10·0°	22·40	veg. debris, desmids, diat.	A. P. Smith.
Salford	,,	yellowish	none	·60	none	none	·0014	·0021	·0257	·0392	3·0°	2·5°	3.50	none	J. Carter Bell.
Shrewsbury ..	,, 7	c. colourless	none	1·45	traces	·296	·0005	·0010	·0030	·0070	23·0°	7·0°	25·00	none	T. P. Blunt.
Southampton ..	,, 19	f. grnsh. yellow	none	·77	h. trace	·480	·0028	·0049	·0290	·0990	12·6°	4·6°	18·60	satisfactory	A. Angell.
Swansea	,, 14	clear	none	·80	trace	none	·0007	·0063	·0020	·0040	1·5°	1·5°	3·71	none	W. Morgan.
Whitehaven ..	,, 6	c. f. green	none	·34	traces	·007	none	·0017	·0100	·0180	·4°	·4°	1·87	satisfactory	A. Kitchin.
Wolverhampton	,, 10	s. yellow	none	1·33	traces	·084	none	·0042	·0201	·0389	13·7°	6·2°	20·86	diatoms, vegetable debris	E. W. T. Jones.

Abbreviations:—c., clear; f., faint; h., heavy; p., pale; v. h., very heavy; v. s., very slight.

ERRATA.—In the September Table the Nottingham Chlorine should have been 1·49 instead of ·149; Reading Chlorine should have been 1·10 instead of ·11.

THE PUBLIC WATER SUPPLIES OF ENGLAND.

VALUATION, ACCORDING TO WIGNER'S VALUATION SCALE, OF THE ANALYSES PUBLISHED THIS MONTH.

In the following table we give the *average* valuation of those public water supplies reported on this month from January to June, and the valuation of the July, August, September and October waters.

	Average to June.	July.	August.	Sept.	October.
LONDON—					
Kent	30	27	20	27	29
New River	26	17	17	21	24
East London	32	39	20	28	35
Southwark and Vauxhall	34	28	31	27	30
West Middlesex	30	24	29	39	33
Grand Junction	30	23	25	30	31
Lambeth	37	29	31	26	33
Chelsea	30	26	32	36	37
Bath	12	19	20	..	13
Birmingham	33	37	26	29	36
Bolton	..	17	19	17	28
Bradford	53	53	59	44	36
Brighton	24	23	25	21	22
Bristol	22	27	..	30	29
Bury	..	35	24	24	30
Cambridge	28	26	22	21	22
Canterbury	17	22	16	12	15
Croydon	27	30	..	..	22
Darlington	33	39	96	50	74
Derby	18	13	..	..	..
Dublin	23	..	13	..	..
Edinburgh	28	21	20	24	31
Exeter	20	16	23	23	18
Grantham	27	..	32	..	70
Hastings	..	20	25	..	27
Huddersfield	23	26	28	..	..
Ipswich	27	30	30	..	28

	Average to June.	July.	August.	Sept.	October.
King's Lynn	94	110	48	110	84
Leamington	26	..	26	..	24
Leeds	35	28	22	..	..
Leicester	42	24	26	23	25
Liverpool	36	29	41	47	37
Maidstone Water Company	39	34	30	31	38
,, Public Conduit	36	28	25	27	31
Manchester	22	17	29	28	49
Newark	39	46	41	..	33
Newcastle-on-Tyne	37	40	43	68	57
Norwich	36	49	36	33	34
Nottingham	39	46	38	42	62
Plymouth	29	..	..	28	..
Portsmouth	30	22	26	27	24
Reading	25	20	34	23	25
Rochdale	9	7	9	..	5
Rugby	41	..	..	46	69
Salford	18	14	21	21	15
Sevenoaks	20	..	..	..	..
Shrewsbury	23	..	17	19	21
Southampton	43	..	40	40	40
Sunderland	25	27	..	..	..
Swansea	16	14	19	15	12
Tunbridge Wells	..	..	..	35	..
Warwick	34	34	..	10	..
Whitehaven	9	17	14	10	10
Wolverhampton	46	39	32	15	33

Owing to considerations of space we have omitted from this table those places as to which we have published no analyses during the past four months.

In the case of the metropolitan waters, the average valuation of the supplies for October is 2·2 higher than the valuation for September, which was itself 3·5 higher than that for August, the average valuation for October being 31·5, while that for the first six months of the year was 31·2. The increased valuation is tolerably fairly distributed among the different companies, except the West Middlesex, which shows a considerably decreased figure in oxygen absorbed.

All the samples are, however, still well within the limits of first-class water, and quite fit for a public water supply.

Among the provincial supplies reported on this month, the most pure are Rochdale, with a valuation of 5; Whitehaven, 10; Swansea, 12; Bath, 13; Canterbury and Salford, 15 each; and Exeter, 18. In most of these cases there is a slight but quite perceptible improvement upon last month's reports.

In the case of Whitehaven the figure of last month's valuation should have been 10 instead of 30.

Following these best waters, we have Shrewsbury with a valuation of 21; Brighton, *Cambridge and Croydon*, 22 each; Leamington and Portsmouth, 24 each; Leicester and

Reading, 25-each; Hastings, 27; Bolton and Ipswich, 28 each; Bristol 29, and Bury 30. There are comparatively few changes of note in these figures, the most important change being probably that of Bolton, where a considerable increase on the proportion of oxygen absorbed has increased the valuation from 17 to 28.

The valuations of Bradford, King's Lynn, Liverpool and Newcastle show an improvement over the results of last month; while on the other hand the analyses of the waters from Darlington, Edinburgh, Grantham, Maidstone, Manchester, Nottingham, Rugby, and Wolverhampton give less satisfactory indications.

On the whole the general autumn and winter deterioration in the character of the supplies is making itself shown all over the country.

OCCURRENCE OF ARSENIC AND VANADIUM IN CAUSTIC SODA.

Since caustic soda is no longer exclusively made from crude soda and lime, but is also produced directly from red liquor, the product is often contaminated with undue proportions of chlorides, sulphates, carbonates, even nitrites, and sometimes cyanogen compounds. The author has now also met with arsenic and vanadium in caustic soda. The latter impurity may be disregarded, being rare and very minute; but the former is more serious. A sample of this caustic soda, dissolved in dilute sulphuric acid, and the solution tested directly in Marsh's apparatus, yielded a strong arsenic mirror. Assay by means of precipitation with hydro-sulphuric acid, &c., yielded 0·16 per cent. of arsenic acid. The same sample contained also 0·014 per cent. of vanadic acid. The latter may be recognised by passing through a solution of the caustic soda a current of hydro-sulphuric acid, when the liquid will finally assume an intense reddish-violet. This is filtered and acidulated with dilute sulphuric acid, when a precipitate will be obtained which, after being washed, will produce with borax a yellow bead in the outer blow-pipe flame, and a green bead in the inner. On heating the precipitate in the air, a reddish-yellow mass is obtained which is soluble in ammonia with a yellow colour. The latter solution, slightly acidulated with hydrochloric acid, yields a bluish-black precipitate with infusion of nutgalls.—*Dingler's Pol. Journ.*

MILK ANALYSIS AT MANCHESTER.

The following correspondence will be of interest to our readers:—

To the Editor of "The Manchester City News."

Sir,—In your issue of Saturday last you report a case in which a farmer was fined 40s. on the report of Mr. Estcourt, the city analyst, that it contained "eight per cent. of added water," although evidence was given on behalf of the defendant that no water had been put in. Permit me to give my experience of a recent occurrence:—On the 9th August I was at a farm in Chadderton, when a desire to "test" the analyst of the City of Manchester came upon me. I have long had an opinion of my own about the value of certain analyses. With the consent of the farmer I went into the shippon—it was then milking time—and I saw two of the cows milked. The milk from each cow was poured into a larger milk pail, and about a quart of this liquid was poured into a jug, and a bottle was at once filled from the jug. I put a cork into that bottle, and conveyed it to Mr. Estcourt's office in Manchester, on my next journey thither on the 12th. I asked Mr. Estcourt's assistant what it would cost to analyze it, and I was informed 15s. 9d., which sum I paid. I was next subjected to a cross-examination, which reminded me very forcibly of the process which a young lady would have to undergo if she paid a visit to a gipsy in order to obtain a look into futurity. Let me here say that for obvious reasons I gave a feigned name and address—that of a friend in Lower Broughton. In due course I received the report of the analyst, which stated that the sample contained "added water," and that it was deficient in fat.

My curiosity was excited, and I determined to gratify it. I therefore visited Mr. Estcourt again and this time I was the "pumper." The result of what came out in our conversation, of which I took notes in Mr. Estcourt's presence, was that the sample of milk which I took to him had from 20 to 50 per cent of "added water," according to the standard of quality set up as the ideal standard, but at the lowest standard of pure milk fixed, it contained the former quantity of "added water." "Now as to the fat, Mr. Estcourt; you say it is deficient in fat. Has fat been abstracted?" His reply was "Yes." "What percentage?" "Taking the quality of the milk as a low one, from four to ten per cent of fat has been abstracted."

I am prepared to prove that the milk in question was pure milk, just as it came from the cow, and that it contained no added water whatever, nor had any fat been abstracted from it when handed in for analysis, and I challenge Mr. Estcourt to have the matter tried fairly out. Mr. Headlam may well exclaim, in connection with the case he tried, that "it was a most extraordinary thing that there was water in the milk, when nobody appeared to have put it there." Mr. Estcourt's explanation will probably be that some of the cows are more cunning than honest to the farmer who supplies them with food and shelter.

I have said nothing here but what has been proved and admitted on oath before magistrates, and remain, without further comment, yours truly, S. WALL.

Union Street, Oldham.

In reply to this communication, Mr. Estcourt sent a letter, from which we take the following:—

About four years ago a farmer, named Cheetham, of Chadderton, was fined in the Oldham Police Court £20 and costs for milk adulteration. On July 13th last, among the samples received from the Oldham authorities for analysis, two were returned by me as having been skimmed—one to the extent of 36 per cent., the other 60 per cent. On attending court at Oldham, on 4th August, in these cases, I found the vendor of the two samples was the same farmer, Cheetham. The cases were heard, and the defence offered was that the summonses were short-served. The cases were dismissed and the magistrates granted fresh summonses to be heard 20th August. Between the two hearings the farmer, who might easily have obtained an independent analyses of the two *duplicate* samples which were delivered to him on 13th July, engaged Mr. Wall to assist him in preparing a sample, ostensibly to test the modern method of milk analysis, in reality to mystify the authorities. As will be seen, the defendant afterwards admits in his evidence the accuracy of the method.

The S. Wall sample however—taking his own statement in evidence—was *fore* milk, and was therefore not milk such as ordinary purchasers expect to get. It was milked from *two* cows only (selected by the farmer), not from the herd, as were my samples. It was milked on 9th August, yet not delivered at my laboratory until the 12th. When received here it was not sour, or curdled, as samples of milk are found to be after three days' keeping by ordinary persons. All these facts do not lend much aid in proof of its identity with the milk said to have been obtained from the cows at Chadderton.

As stated in my report to Mr. Wall, the sample had (taking good milk as standard) been watered and skimmed. As to the verbal information Mr. Wall received, and which he wrote down, with his book under the edge of my writing table, he has either ignorantly or designedly confused and inverted the sense, for I distinctly told him that there was, taking good milk as a standard, three per cent. of water added and forty to fifty per cent. fat gone, which fact in his evidence he practically admits by stating that it was fore milk.

In the reports of the case, the farmer and his wife both state that in one case they sold only the fore or first part milked, and kept the last portion of the milking to be used by them for making butter. In the second case they declare *they skimmed the milk*. In my certificate, when I find a deficiency of cream, I can only state the fact that *the cream has been abstracted*, and on this point the defendant corroborates my certificate of analysis.

In conclusion, Mr. Estcourt says, "alluding to the last paragraph in Mr. Wall's letter, the report of the case proves him to be, to say the least, unreliable, for no part of what he says was *proved* and *admitted* on oath before magistrates."

The following is an abbreviated report of the case referred to, the italics being ours:—

At the Oldham Borough Police Court, on 20th August, before Mr. Knott and other magistrates, James Cheetham, of Chadderton, was summoned for a breach of the sale of Food Act. Mr. J. Ponsonby, *solicitor, defended* him. J. E. Drew, inspector, stated that on the 13th of July he purchased a quart of

milk from the defendant, a sample of which he took to Mr. Estcourt, the analyst. In reply to Mr. Ponsonby, witness said he did not ask for "fore" milk; he did not know the term. He did not notice that the milk was of a bluish tint. Mr. Estcourt, then stated that 36 per cent. of the fat had been abstracted fron the sample. Mr. Ponsonby asked Mr. Estcourt how long it would take for cream to rise to the top. Mr. Estcourt: It depends upon circumstances. Mr. Ponsonby: Would there be a change in half an hour? Mr. Estcourt: I have no doubt there would. Mr. Ponsonby: How is fat abstracted? Witness: Ordinarily by skimming. Mr. Ponsonby: You are of opinion that the milk has been skimmed? Witness: Yes. Is 36 per cent. an unusual quantity of fat to abstract? I think 36 per cent. leaves an unusually small quantity to sell for new milk. Mrs. Cheetham, wife of the defendant, was then called, and she stated that on the morning of the 13th ult. the milk, after standing at the door in some cold water to cool, was put into a can. The milk sent out was morning's *fore* milk. The "afterings" was kept to make butter and cream. The defendant corroborated his wife's statement, and added that when Drew came to him he said "Sell me a quart of *fore* milk." There was more fat in the after milk than in the fore milk. Stephen Wall was then called. He stated that he procured a sample of milk from the defendant's cows on the 9th. He saw the two cows milked, and the milked poured into one can. It was *fore milk*. Some of it was poured into a bottle, which he delivered to Mr. Estcourt's assistant on the 9th. The Bench ruled that this evidence had no bearing on the case, as it related to milk procured at another time. Dr. Sutton then stated that there was another case against defendant. Drew stated that he purchased a second sample of milk from the defendant, which he called night's milk. Witness paid 4d. for it. Mr Ponsonby: What do you mean by night's milk? Witness: I don't know, sir; it is a term of his own. Was that can marked pure milk? I won't swear that at all. Mr. Estcourt stated that on analysis he found 60 per cent. of the fat had been abstracted from the sample submited to him. Matilda Cheetham, defendant's wife, stated that on the night of the 12th the *milk was skimmed*. The milk was sold as skimmed at 3d. per quart. Defendant stated that he told Drew that the milk was "night's milk" skimmed. He paid 3d. for the milk, which was the usual charge. Dr. Sutton here said this case was a very important one. Sixty per cent. of fat abstracted meant so much starving of children and infants. It was no wonder they found weak children when they were fed on this "material." After hearing Mr. Ponsonby's defence, the Bench retired, and, on returning into court, Mr. Knott said that in the first case the magistrates were unanimously of opinion there must be a conviction. The defendant would be fined £10 and costs. In the second case they were also satisfied there must be a conviction, and a penalty of £10 and costs would also be inflicted in this instance. Mr. Ponsonby: I give notice of appeal. Mr. Knott: There will be time enough for that.

ANALYSTS' REPORTS.

At a late weekly meeting of the Vestry of St. Marylebone, Dr. A. Wynter Blyth, in his quarterly report under the Sale of Food and Drugs Act, states that during the three months ending September 30, 1881, he had tested 27 samples of food—viz., 8 of mustard, 2 of arrowroot, 1 of black and 1 of white pepper, 4 of coffee, and 11 of milk. Two of the latter were moderately diluted with water, while the whole of the other 25 were of fair purity.

Dr. Redwood, in his report for the last financial year of the Holborn Distrtct Board of Works, states that he had received from Mr. G. C. Peacock, the inspector, 73 samples, consisting of bread, milk, butter, beer, ale, whisky, gin, brandy, and rum. With the exception of 18 samples of milk, the whole of the other 55 samples were unadulterated.

LAW REPORTS.

Heavy Fines for Adulterating Bread with Alum:—

At Ramsgate, William Popple, of 78, High Street, pleaded guilty to selling, on the 11th August, to the prejudice of a customer, bread not of the nature, quality, or substance demanded.—Maria Cashford, the wife of a police-constable, said she was employed by Mr. May on the 11th August to go to defendant's shop where she purchased a 2-lb. loaf and paid 3½d. for it. She handed the loaf to Mr. May who was at the door, and Miss Popple, who served witness, called her father, and Mr. May told him he intended to have the bread analysed.—Mr. Edward S. May, Inspector of Nuisances, said he received the loaf mentioned from the last witness, which he requested her to purchase. He saw defendant and told him he intended to have the bread analysed by the Public Analyst. Witness divided the loaf into three

parts, one of which he gave to the defendant, another he delivered to Mr. Sidney Harvey at Cante on the same day, and the other he produced. On the 17th August witness received a certificate st that the sample was adulterated with alum to the extent of more than 27 grains to a 4-lb. loaf, an (Mr. Harvey) added: "I am of opinion that the addition of alum to bread renders the same indige and injurious to health."—Defendant, in reply to the Bench, said his bread turned out rather quee two or three days, and he fell back upon "that stuff;" it was unusual for him to use it, and unf nately Mr. May had one of the loaves.—The Chairman said defendant had made no tangible excuse the Bench fined him £5 and 11s. costs.

John Sutton, of 18, Queen Street, pleaded not guilty to a similar charge.—Mrs. Cashford pr purchasing a 2-lb. loaf for 3½d. of Mrs. Sutton. Mr. Sutton was called into the shop and the Insp told him he should have the bread analysed.—Mr. May said he received the loaf in question fron last witness (whom he employed), in the shop, and told defendant he should have it analysed by Public Analyst, whose certificate, dated the 18th August, he now produced. It stated that the sa received from witness on the 11th August, and marked 31, was adulterated with alum to the exte more than 13 grains in a 4-lb. loaf.—Defendant said if there was anything in his bread, it was in flour when he purchased it.—The Chairman said that, although there was less alum, the Bench f no difference in the cases, and defendant was fined £5 and 11s. costs.

In reply to the Bench, Mr. May said he submitted ten samples to the Public Analyst, but these the only two cases he had brought against bakers for adulterating bread with alum. The ana however, remarked that in all the samples there was from three to six per cent. of moisture more good bread ought to contain, and pointed out that this excess of water in the bread was a "ser fraud" which did not fall within the scope of the Act of Parliament.

A Tremendous Fine:—

At West Hartlepool, recently, two heavy penalties were inflicted by the county magistrates for adulteration. In the first case, a farmer, named Thomas Robinson, charged for the third time with offence, and the analysis showing that 33 per cent. of water adulterated the milk, was fined £50 costs, or three months' imprisonment. In the second, Frederick Levers, a milk-seller, whose milk analysis showed 22 per cent. of water, was fined £10 and costs, or six weeks' imprisonment. A th where a slighter adulteration was proved, was adjourned for the appearance of the original seller.

Decision as to the 28 Days' Limit Required by the Act:—

At Sunderland, Hamilton T. Hardman, provision merchant, and the occupier of a stall in the Ma was lately charged by William McKay, inspector of nuisances to the Corporation, with selling bu adulterated to the extent of 76 per cent. with foreign fats, on the 30th June. Mr. F. M. Bowey, De Town Clerk, appeared in support of the charge, and Mr. Marshall defended. The inspector pr buying the article as butter, and a certificate from Dr. Yeld, the borough analyst, stated that it adulterated to the extent named. Mr. Marshall said he had an objection to the summons to raise. alleged offence was committed at noon on the 30th June, and the summons was not served until evening of the 28th July. He contended that as more than 28 days, allowed by law, had elapsed, summons must break down. Mr. Bowey, in reply, said if the summons had not been served within days, as regarded the hours, it had been legally served as regarded the days themselves. The Be overruled the objection. Mr. Marshall said his defence to the charge was that the defendant's so little boy, who had perhaps somewhat carelessly been left in charge of the stall, had inadvertently butterine for butter, and even though an offence might thus have been committed, he asked the Be to deal leniently with the defendant. The Bench considered the case proved, and fined the defendant and costs, a distress warrant to be issued in default.

A Milk-Vendor Sentenced to Imprisonment:—

At Ramsgate, Edward Coleman was summoned for selling to the prejudice of Edward Step May, milk not of the nature, substance, and quality demanded.—Defendant pleaded not guilty.—Mr J. Mercer appeared for defendant.—Mr. May said that on Tuesday, the 9th August, he met defend with his cart at the top of Meeting Street, and asked him for a pint of milk. Defendant took the m from one can, and witness paid him 2½d. for it, telling him he intended to have it analysed by

public analyst. He divided it into three parts, one of which he delivered to Mr. Harvey the same day. He produced a certificate, dated 11th August, from that gentleman, which stated that the sample was adulterated with 15 per cent. of added water.—Cross-examined: Did not think defendant told him he bought the milk of anyone. Did not say he never put water in it, or that he had had it from three different people, and he thought it was quite pure.—Mr. Mercer said that practically there was no defence to this case, as his client had not thought fit to get a certificate from whom he bought it. He suggested that the first customers got the best of the milk, and submitted that 15 per cent. of added water was not a great deal.—The Chairman notified their intention to convict in this case, but said they would hear the other summons against the defendant before deciding upon the penalty.

Defendant (Coleman) was then further charged with having in his cart, on the same date, certain "milk," apparently for sale as food for man, which had been condemned by two of Her Majesty's Justices as being unfit for the food of man.—Defendant pleaded not guilty.—Mr. E. S. May said that on Tuesday, the 9th August, he was coming down High Street, and on looking up George Street he saw the defendant with a horse and cart. Upon observing witness, defendant whipped up the horse and drove up into Meeting Street. Witness then went back up High Street, and, on looking up Meeting Street, saw defendant get out of his cart with the intention of serving two of his customers, but as soon as he saw him (Mr. May) he turned his pony round and drove off to the end of the street again and round the corner without serving his customers. Defendant was just about to drive off when witness overtook him. He then purchased, as stated in the previous case, one pint of milk, which defendant took from one can in the cart. After purchasing it, witness asked defendant why he served him from that particular can, and he replied that it was "all the same sort" in the other two cans. Witness asked him to open the lid of the centre can, which he did, and it was empty. He then asked defendant to open the lid of the third can, which he declined to do, again stating it was "all the same," and there was no need for him to open it. Witness then removed the lid, and found the can contained about a gallon of liquid which looked like milk; he seized it, and took it out of the cart, as being unfit for the food of man. After setting it down on the pavement he gave defendant an opportunity of explaining why he was carrying it, but he gave no explanation whatever. Witness brought the contents of the can before two of Her Majesty's Justices of the Peace, on the 11th ult., when defendant was present, and an order was made condemning the "milk" as unfit for the food of man. Witness produced a sample of the "milk" taken from the can he seized (a mixture resembling soap-water, with lumps of apparently soap floating in it). Witness sent a similar sample to that produced, taken from the can, to the Public Analyst (Mr. S. Harvey) from whom he received a certificate stating that it consisted of water with less than one per cent. of milk. There was no other matter detected in it, and witness asked the analyst to look especially for blood. The can seized was very filthy inside, and there was a bad smell about the contents. The witness said that he would like to add that he had had several complaints from the defendant's customers.—Cross-examined: He had not discovered that this water was used to bathe the pony's leg; he had discovered just the contrary. Defendant gave him no explanation as to what the water was for until six hours afterwards, when he stopped him coming from the station at ten o'clock at night, and said he wished to tell the "truth" about it. Defendant said his pony was frightened by a bicycle, and slipped down on the kerb in Effingham Street, cutting its knee, and he got the water from a person's house in the neighbourhood to bathe it with, using the rag that was on the top of the can. Defendant told witness he used the rag as he had no other. He did not explain that the colour of the water was caused by using the milky rag and soap. Defendant at the same time told witness that he used the can seized for collecting fowls' victuals in, and that it had nothing to do with the milk. Witness had every reason to believe that the water was carried in the cart to mix up with the milk.—Witness added to his evidence in chief that he had examined the pony's knees with Police-Constable Axon, and there was not the slightest symptoms of any recent injury.

After some corroborative evidence had been given, Mr. Mercer, for the defence, said he was instructed that this was a malicious prosecution. The statement made to him by his client (who could not be put in the witness box) was that on the day in question his pony was frightened by a bicycle and that it fell down on to the kerb in Effingham-street and cut a piece out of its knee about the size of a five-shilling piece. He went to his sister's and procured some water which had soap in it to bathe the pony's knee. Unfortunately, Mr. May caught him and tried to suggest that it was in his cart for the purpose of adulterating the milk; he submitted that it was not likely a man would run such a risk. He (Mr. Mercer) had sent for the defendant's sister who supplied the water, but she had not arrived, and as this was a most serious case for his client he asked for an adjournment to enable her to get there.—The Bench expressed the opinion that defendant had ample time to get his sister there.—Mr. Mercer said the

sister had been sent for, and he hoped their Worships would give him the opportunity of calling her, as defendant, he admitted, ought to be severely punished if he were found guilty. In conclusion, he submitted to their Worships that the summons must fail, inasmuch as the defendant had been summoned there for selling "certain milk," whereas the analyst said there was no milk, only one per cent., and that was to be accounted for by defendant having used the milk rag in the water to bathe the pony's knee.—The Magistrates retired, and after a short absence returned to the Court, when Mr. Mercer said he thought his witness was present, if they would allow him to call her.—The Chairman said that if it was only as to her giving defendant the water it would not alter his decision. He then said that in the first case—which was that of selling adulterated milk—defendant would be fined 40s. and 10s. costs, or one month. In the other instance—where the "milk" was unfit for the food of man—the Bench considered it a very gross case, and they would send him to prison for one month's hard labour without the option of a fine.—Defendant paid the 50s., and was removed in custody.

Sarah Austen, of 12, La Belle Alliance Square, was summoned for a similar offence, and her son appeared.—Mr. May having given evidence, put in the analyst's certificate, which stated that the milk was adulterated with 11 per cent. of added water.—Defendant's son said they could not be answerable for the milk; it was the dairy farmers who adulterated it and derived the benefit.—Fined 30s. and 11s. costs. The money was paid.

Horder v. Meddings.—Coffee adulterated with 75 per cent. of chicory. Coffee asked for by purchaser after sale, but before delivery. Vendor labelled it a mixture, &c., on proof of which fact the magistrate refused to convict. Case remitted to magistrate because he had not found whether the statement of the mixture was for the purpose of concealing fraudulent increase in the bulk of the article. Semble that it was—otherwise vendor's defence good.—44 J.P. 234.

New York State Adulteration Act.—With reference to the list of groups of drugs and food, and the chemists to whom they had been assigned for examination, published in our September number, we are informed that the work now being done in the State of New York on the examination of food is only preliminary, and that later each analyst will examine whatever samples are submitted to him by the proper authorities, without regard to any particular group previously examined.

By the Act recently passed by the New York State Legislature, the State Board of Health were authorized to investigate the subject of adulterations in food, and they have already begun work. Inspectors have been appointed to collect and analyze samples of butter, beer, baking powder, bakers' chemicals, cocoa, cordials, canned food, confections, cereals, cheese, meat extracts, fish and fish extracts, fruit essences, ether, gelatine, honey, ice-cream, milk, molasses, lard-oil, olive-oil, quinine, sugar, syrups, soda-water, spices, spirits, tea, wine, and all pharmaceutical preparations. It may be remembered that partial investigation of this kind was made some time ago by the City Board of Health. They found that in the case of sugar of one hundred and nine samples, forty-five only were thoroughly pure and good; fifty-one, however, contained only accidental dust, while eight were marked dirty, and five were dirty. Still, in no case was there any intentional adulteration, and all the samples were free from glucose, which substance is now largely introduced. It is not likely that much which is really injurious will be found, though adulterations may be numerous enough. Still, in the matter of teas, coffee, spices, condiments, confectionery, and diseased or putrid meats, there is no doubt room for plenty of investigations.

CORRESPONDENCE.

[The Editors are not responsible for the opinions of their Correspondents.]

To the Editor of "The Analyst."

Sir,—The enclosed letter is, I think, so amusing, that it might be inserted in The Analyst, along with the reply. I need scarcely add that I was *not* asked to proceed with the analysis; but it is only fair to the merchant to say that I tasted his whisky and found it very good.

Yours faithfully,

Oct. 24th, 1881. W. WALLACE.

(Enclosure.)

——— , *Oct* 11*th*, 1881.

Dear Sir,—Per this post I have written Mr. ———, ——— Street, Glasgow, to send you from his Customs' Bonded Warehouse a labelled bottle of my blended whisky lying in bond there. Will you kindly let me know your fee for analysing the same and granting a certificate somewhat like the following. I wish to push the sale of a really good whisky in this Island (——) in place of the new and inferior whisky generally sold. I believe my blend possesses all I state on other side.

Yours truly,

———

Dr. Wallace, Analytical Chemist,
138, *Bath Street, Glasgow.*

"I have obtained from the Custom's Bonded Warehouse in Glasgow a bottle of your 'Old Highland Whisky,' and after a careful examination and analysis of it, I find it to be an absolutely pure, old, well matured, mellow whisky. It is an excellent and wholesome medicinal and dietetic stimulant, without a trace of fusel oil."

City Analysts' Laboratory,
138, *Bath Street, Glasgow Oct.* 14*th*, 1881.

Sir,—I shall be glad to make an analysis of the sample of whisky, and to give an honest opinion regarding it, my fee for which is ——.

My certificate is not likely to be quite so flattering as the form you send in your letter. If the spirit were absolutely pure it would not be whisky at all; and as I am not a medical man, but only a chemist, I cannot give any opinion as to its medicinal and dietetic qualities.

Yours truly,

W. WALLACE.

OLEFINES IN SHALE AND PETROLEUM PRODUCTS.

To the Editor of "The Analyst."

Sir,—I was away from home when the proof of my paper "On the Relative Proportions of Olefines in Shale and Petroleum Products" was sent to me for correction, and hence it has been printed with some errors, which I shall be obliged if you will allow me the opportunity of correcting.

1. On page 178, line 10, after "brominated" insert the word "oil."
2. On page 179, lines 2 and 3, for "the sulphate" read "thiosulphate."

I must also protest against the spelling adopted by the printer, who evidently has strong opinions on the subject of chemical nomenclature. I should not like the readers of The Analyst to think I was responsible for such a term as "paraffine."

I may take this opportunity of protesting against the loose terminology adopted by chemists, from whom we might look for better things. It is bad enough to have the terminative *ine* applied to glucosides as well as organic bases, but it becomes intolerable when used for hydrocarbons. We might do much to prevent such abuses of our scientific language by greater care ourselves. There is no reason why we should not write "benzo*lene*," "gaso*lene*," and "vase*lene*" for the petroleum products; and I should much like to see the ethylene series of hydrocarbons called ole*fins* or ole*fenes*, instead of ole*fines*. Benz*ol*, too, is an objectionable name, and when used should be limited to the complex *mixture* of hydrocarbons from coal tar, of which benz*ene* is the leading constituent.

Yours truly,

ALFRED H. ALLEN.

What is Adulteration of Food?—An American contemporary says: A recent decision in a case of alleged adulteration of buttermilk is of interest in connection with our present new adulteration laws. The judge in this case quashed the indictment (which was for watering the milk), and defined adulteration as the addition of some unwholesome ingredient for the purpose of cheating, by making the purchaser pay more than it was worth.

The *Correspondence Scientifique* gives some details of the new method of ext i magnesia from sea water. The magnesia can be precipitated by lime, like any more concentrated solution. After precipitation and allowing to stand during a day, one cubic metre of sea water gives a precipitation of gelatinous magnesia equal to a volume of 80 litres. A dilute quantity of phosphoric acid is then used, and the final precipitate is considered to be a good fertilizer. The method has not yet been tested on a large scale.

Mr. J. Falconer King, City Analyst, Edinburgh, has been appointed Public Analyst for the County of Roxburgh.

RECENT CHEMICAL PATENTS.

The following specifications have been recently published, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

No. 1880	Name of Patentee.	Title of Patent.	Price.
5282	G. De Laire	Preparation of Vanalline	4d.
1881			
781	H. J. Haddan	Extracting Oxygen from Atmospheric Air	6d.
868	H. Guiliani	Preparation of Vegetable Substances for Food	4d.
894	J. J. Sachs	Electric Lamps	6d.
896	W. H. Atkinson	Refining Camphor	6d.
963	H. J. Haddan	Dry Copying Ink	2d.
968	W. Weldon	Manufacture of Chlorine	6d.
980	Do.	Manufacture of Soda	2d.
983	A. Parkes	Treatment of Cellulose, &c.	6d.
1002	T. & G. Priestman & J. Longshaw.	Treatment of Tan Liquors for Manufacture of Ink ..	2d.
1027	J. A. Berly	Electric Lamps	4d.
1040	A. A. Common & H. F. Joel ..	do.	6d.
1048	J. Imray	Manufacture of Maltose	2d.
1063	J. H. Johnson	Treatment of Ores, &c.	2d.
1161	E. Carey & H. Gaskell	Purification of Alkaline Solutions	4d.
1202	M. P. W. Boulton	Caloric Engines Heated by Internal Combustion of Gas	4d.
1212	J. A. Dixon	Production of Colouring Matters from Para-Nitrobenzaldehyde, &c.	4d.
1225	Do.	Manufacture of Colouring Matters and Preparation of a new Mono-Sulpho Acid of Beta Napthol	4d.
2179	Do.	Production of Metaoxybenzaldehyde	4d.
2543	A. J. Boult	Manufacture of Soap	4d.
2997	C. Semper	Manufacture of Sulphate of Alumina	2d.

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; Journal of Applied Science; The Provisioner; The Practitioner; New Remedies; Proceedings of the American Chemical Society; Le Practicien; The Inventors' Record; New York Public Health; The Scientific American; Society of Arts Journal; Sanitary Engineer of New York; The Chemists' Journal; Oil and Drug News; The Textile Record of America; Sugar Cane; Country Brewers' Gazette; The Medical Record; Oil and Drug Journal; The Canada Lancet; The National Live Stock Journal; Relative Advantages of Wind, Water and Steam, by S. B. Goslin.

THE ANALYST.

DECEMBER, 1881.

SOCIETY OF PUBLIC ANALYSTS.

A General Meeting of this Society was held on the 16th inst. at Burlington House. The chair was taken by Dr. Muter, F.C.S., F.I.C., Vice-President.

The minutes of the previous meeting were read and confirmed.

The ballot papers having been opened, it was reported that Mr. W. J. R. Simpson, M.D., Aberdeen, had been duly elected a member.

The following were proposed for election:—As a Member: Mr. C. N. Hake, F.I.C., Analytical Chemist, London. As Associates: Mr. J. P. Laws, assistant to Mr. Bernard Dyer; and Mr. F. T. Strutt, assistant to Dr. Hodgson Ellis, of Toronto.

Messrs. Dyer and Hobbs were appointed auditors to examine the accounts for the current year.

The following papers were read and discussed:—

"On the Estimation of Nitric Acid," by J. West-Knights, F.C.S., F.I.C.

"Note on Sugar Titration," "Somerset House Analyses," by O. Hehner, F.C.S., F.I.C.

"On the Effectiveness of Centrifugal Machines for the Separation of Cream from Milk," by A. Smetham.

A Special General Meeting will be held at Burlington House on Wednesday, the 14th December next, at 8 o'clock, and among the Papers to be read will be the following, announced for the last meeting, but unavoidably postponed—"Some Observations on the Permanganate Test," by A. Dupré, Ph.D., F.R.S., &c., and also "A New Method of Testing for Alum," by A. Wynter Blyth, M.R.C.S., &c.

ON THE ESTIMATION OF NITRIC ACID.

By J. West-Knights, F.I.C., F.C.S.

Read before the Society of Public Analysts, on 16th November, 1881.

It is generally supposed that nitric acid in acid solution is only partially converted into ammonia by nascent hydrogen (Fresenius' Quantitative Analysis, 6th edition, p. 348); but I have found that it is quite possible to obtain the whole of the nitric acid present, in the form of ammonia, when proper precautions are taken. When a nitrate is dissolved in water in the presence of sulphuric acid and zinc, the N_2O_5 is first converted into N_2O_3, and after prolonged action the latter is completely converted into NH_3 by the nascent hydrogen.

As the reduction, when once started, requires but little attention until completed, the time occupied is of little importance, as the analysis can be left standing all night, and will,

in most cases, be complete in the morning. After the reduction the NH_3 can be distilled into standard acid after making the solution strongly alkaline with caustic soda, and estimated in the usual way by titrating the residual acid with half normal alkali.

Before commencing the distillation it is necessary to test the completeness of the reduction; this is best done by adding about 1 c.c. of decinormal permanganate solution. If the permanganate is quickly destroyed, nitrous acid is still present, and the reducing action must be continued; but if, on the other hand, 1 c.c. produces a permanent tint, the action may be considered complete.

The process will be best described by giving examples: Six separate quantities of 0·5 grm. of pure nitrate of potash were taken and each dissolved in about 80 c.c. of water, 10 c.c. of H_2SO_4 (one vol. acid to three of water) was added and a stick of zinc, six inches long, was placed in each flask, and the whole allowed to remain all night; in the morning 5 c.c. more acid was added to again stimulate the evolution of hydrogen. In half an hour the rods of zinc were lifted out, rinsed with distilled water, the samples were tested with permanganate, then rendered alkaline by the addition of three or four short sticks of caustic soda, and distilled into 10 c.c. of normal sulphuric acid contained in a U tube, having a bulb blown on each arm, and being immersed in cold water. After the distillation the contents of the U tube were washed into a beaker and titrated with half normal NaHO with the following results:—

No.	$K_2Mn_2O_8$ destroyed.	Standard Acid neutralized =	KNO_3
1	2·0 c.c.	4·9 c.c. =	·505
2	1·0 c.c.	4·9 c.c. =	·499
3	0·0 c.c.	5·0 c.c. =	·505
4	0·0 c.c.	4·9 c.c. =	·494
5	·5 c.c.	4·9 c.c. =	·496
6	2·0 c.c.	4·8 c.c. =	·494

The calculations are made, in the case of nitrate of potash, by multiplying the number of c.c. of permanganate and acid respectively by ·00505 and ·101, and adding the results together; but I prefer to have the whole of the nitrous acid converted into ammonia, or at least not to have more than is equal to 1 c.c. of permanganate left, as experiments made in which one-third or one-half of the whole of the nitrous acid was purposely left unconverted, and allowed for by titration with permanganate, were very unsatisfactory.

I think this method will be found more simple and manageable than Harcourt's, and the results fully as accurate; but, of course, reducible and oxidizable substances, as iron, &c., must be absent.

NOTE ON SUGAR TITRATION.

By Otto Hehner.

Read before the Society of Public Analysts, on 16th November, 1881.

The reaction between sugar and Fehling solution has, during the last few years, been the subject of a number of critical investigations, and it has been proved that it cannot be expressed by any equivalent relation, but that the reduction of Cu_2O is a function of concentration, alkalinity, time of heating, and other circumstances—and that, in fact, the method only gives correct results when similar conditions are as nearly as possible adhered to.

These investigations only applied to Fehling solution as ordinarily made, with copper sulphate, alkali, and tartrate. Having some years ago (*Chem. News*, xxxix. 197) tested, and obtained *under certain conditions*, very satisfactory results, with the ammoniacal Fehling solution, proposed by Dr. Pavy (*Chem. News*, xxxix. 77), and having proved that the amount of alkali present in it greatly influences the ratio of reduction, I was led to examine the influence of other substances upon the same.

The presence of ammonia in the copper solution renders that of tartrate unnecessary, the tartrate merely being used to keep the alkali from precipitating cupric hydrate. As glucose readily reduces copper sulphate in plain ammoniacal solution—although much less rapidly than in the presence of potash—it seemed most advantageous to start with such simple ammoniacal solution only, and thus to avoid possible complications due to the tartrate or alkali. Using the copper solution of the ordinary strength, 34·639 grammes of the sulphate per litre, and employing a glucose solution which had been obtained by inverting cane sugar by 10 per cent. HCl. and exactly neutralizing with soda, I assumed for the purpose of comparison only, that the ration of reduction of Cu_2O was the same under the circumstances of the following experiments as with ordinary Fehling solution. This, of course, is not the case, but the results, percentically expressed, give the measure of any fluctuation.

Sugar determined—

With $CuSO_4 + NH_3$	obtained	90·70 per cent. glucose.
" "	"	90·00 " "
+ 1·5 grm. iod. pot. tartrate	"	114·9 " "
+ 6 grms. tartrate ..	"	146·6 " "

A new sugar solution exactly neutralized with NaHO gave—

With $CuSO_4 + NH_3$	100·3
" "	99·8 per cent. of glucose taken.
+ 1 grm. tartrate	123.9
+ 2 grms. "	126·1
+ 5 " "	135·8
+ 10 " "	142·1
$CuSO_4 + NH_3$ + 2 grms. sod. acetate	98·9 per cent. glucose.
+ 5 " " "	99·3 " "
+ 10 " " "	99·0 " "
$CuSO_4 + NH_3$ + sod. carbonate, dry, 1 grm...	105·7
2 "	108·1
5 "	112·6
10 "	113·4
$CuSO_4 + NH_3$ + 1 grm. NH_4Cl.	79·7
+ 5 " "	79·9
+ 10 " "	81·8

The figures speak for themselves—they show that the ratio of reduction is influenced to a very considerable extent by the substances experimented upon, the percentages being raised or depressed according to the nature of the addition, and that, therefore, sugar titration by ammoniacal copper solution can only give correct result by a concurrence of favourable circumstances, and only when certain conditions are scrupulously adhered to. Of course, in actual work, neither the quantity of tartrate nor of potassium carbonate would fluctuate so widely as the extremes in the test experiments quoted; but a fluctuation must necessarily follow any variation in the strength, dilution, or composition of the test fluid. While I, therefore, fully concede that correct results may be obtained by means of ammo-

niacal copper solution, yet it is evident that the method is devoid of the essential conditions of a trustworthy analytical method.

An ammoniacal solution of sulphate of copper cannot, without further addition, be utilised for determining sugar, on account of the slowness of the reaction, and because the end-point of the titration is not sufficiently distinct.

NOTE ON THE EFFICIENCY OF CENTRIFUGAL MACHINES FOR THE SEPARATION OF CREAM FROM MILK.

By Alfred Smetham, F.C.S.

Read before the Society of Public Analysts, on 16th November, 1881.

The application of centrifugal force to the separation of cream from milk is not new to the scientific world, and analyses of the skim milk so obtained have already been published; but as I have lately had the opportunity of comparing two different forms of apparatus under precisely the same conditions, and have analysed both the cream and skim milk produced, I have thought that the results might prove interesting.

The two forms on which I experimented were the "Danish" and the "Laval." The former is a recent invention and was only introduced into England in July last, when it was exhibited at the Royal Agricultural Society's Show at Derby, while the latter is comparatively well known, and has been in use for several years.

The "Danish" has an advantage in the fact that the tube by which the cream is conducted after separation is adjustable (whereas in the "Laval" it is fixed), and cream can therefore be obtained of any density—no matter at what rate the separation is taking place. The difference is clearly marked in the following analyses, which were obtained from two portions of the same delivery of milk:—

	"Laval" Running 29½ gals. per hour.	"Danish" Running 43½ gals. per hour.
Water	61·46	52·32
Fatty Matters	33·44	42·68
Casein, Albumen and Milk Sugar ..	4·56	4·42
Mineral Matters	·54	·58
	100·00	100·00

The skim milk obtained at the same time had the following composition:—

	"Laval" Running at 29½ gals. per hour.	"Danish" Running at	
		43½ gals. per hour.	52½ gals. per hour.
Water	91·72	91·82	91·36
Fatty Matters	·29	·11	·44
Casein and Milk Sugar ..	7·22	7·32	7·41
Mineral Matters	·77	·75	·79
	100·00	100·00	100·10

The power was unfortunately deficient, and it was found impossible to run the machines at their full speed; but, notwithstanding this drawback, it will be observed that the results in both instances were highly satisfactory.

There can be no doubt that by the aid of these machines the cream may be practically all removed—far more completely, in fact, than by the ordinary method of setting; and as, moreover, the cream and skim milk are perfectly fresh, it will be apparent that in large dairies (especially those which supply towns) their use will become almost a necessity.

The actual saving in butter-making, by reason of the more complete removal of the cream, will be very important—to say nothing of the indirect saving in the cost of pans and dairy fittings.

It appears to me highly probable that in the course of a few years the use of these machines will become pretty general, and I fear this will by no means lighten the duties of Public Analysts. By their aid it will be in the power of dairymen to remove the cream at will, without at the same time adding to the staleness of the milk; and it will, therefore, be possible to reduce the cream to any standard fixed by the Society.

In conclusion, I must remark on the low quality of the milk, but this, of course, has practically no bearing upon the efficiency of the machines.

ON ALMEIRA GRAPE JUICE.

By J. Carter Bell.

I had not time to incorporate the following analysis in my paper upon "Grape Juice," which was published in last month's Analyst. The juice is from grapes grown this year, 1881:—

Specific Gravity of Juice	1069
Total Acid in 100 c.c. calculated as Tartaric Acid	·60
Total Ash from 100 c.c.	·312
Per cent. of Ash soluble in water	83·983
" " Insoluble in water	16·020

Chief Constituents in Ash from Juice.

	Grains in gallon.	Per cent.
Potash	113·047	51·730
Soda	4·450	2·036
Sulphuric Acid	22·018	18·386
Chlorine	·692	·317
Phosphoric Acid, combined with Alkalies	10·888	4·982
Lime	3·825	1·750
Magnesia	8·355	3·823
Phosphate of Iron	·224	·102
Phosphate of Alumina	·336	·153
Phosphate of Lime	17·472	7·995
Silica	·280	·128

REPORT ON CONDENSED MILK.

By Dr. Aug. Voelcker.

(From the *Journal of the British Dairy Farmers' Association*).

The majority of the samples sent in for competition was condensed milk, obtained by evaporating milk partially skimmed, at a low temperature, and with the addition of white refined sugar. A few exhibits were unsweetened milk, or milk evaporated to a certain consistence without the addition of sugar.

Unsweetened Condensed Milk.

The following is the composition of three samples of such unsweetened condensed milk—

	No. 1.	No. 2.	No. 3.
Water	56·96	56·92	51·72
Pure butter fat..	16·02	17·09	14·33
*Casein (curd)	8·50	7·62	11·69
Milk-sugar	16·32	16·22	19·51
Mineral matter (ash)	2·20	2·15	2·75
	100·00	100·00	100·00
*Containing nitrogen.. ..	1·36	1·22	1·87

Two of the samples, it will be seen, contained 57 per cent. of water each, in round numbers. The proportions of water left in these samples appear to be far too large to prevent the condensed milk turning sour on keeping.

On opening one of the tins in which the milk was sent in for competition, the condensed milk was found in an active state of fermentation; and the two other samples turned acid and entered into fermentation the day after opening the vessels in which they were contained.

In the preparation of these and the sweetened samples of condensed milk, neither boracic acid, borax, or preparations containing boracic acid (glacialine), nor salicylic acid, or other preservative agents had been used.

CONDENSED MILK (SWEETENED).

The following is the composition of condensed and tinned milk, in the preparation of which white sugar has been used:—

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.
Water	21·68	23·49	22·45	24·53	23·49
Pure butter fat	9·92	6·47	10·60	6·22	9·53
*Casein (curd)	9·19	9·27	8·82	9·44	7·43
Sugar	56·98	58·66	55·96	57·72	57·34
Mineral matter (ash) ..	2·23	2·11	2·17	2·09	2·21
	100·00	100·00	100·00	100·00	100·00
*Containing nitrogen ..	1·47	1·48	1·41	1·51	1·19

All the samples were well-made condensed milk. Such condensed milk will keep for any reasonable length of time. The proportions of water in the various samples varied from 21½ to 24½ per cent. in round numbers. Milk evaporated to an extent as to leave in the finished tinned milk 25 to 26 per cent. of water, according to my experience, is sufficiently concentrated to keep well if otherwise carefully evaporated with the needful proportion of best white sugar.

Two of the condensed milks, it will be seen, contained respectively 6¼ and 6½ per cent. of pure butter fat; the remaining samples from 9½ to 10½ per cent.

All the samples of sweetened condensed or tinned milk sent for competition were in excellent condition; they were all readily soluble in hot water, and produced, when sufficiently diluted with water, agreeably tasting, sweet, milky liquids. As regards taste and flavour, and miscibility with water, there was little to choose between the different samples sent in for competition; in fact, the condition and quality of most of the samples were so much alike that it was not easy to decide to which kind preference should be given.

The quality of condensed milk, in my judgment, depends more upon delicacy of flavour than upon the proportions of butter fat (cream) which occur in different samples—

that is to say, condensed milk comparatively poor in fat may be, and generally is, preferred by the consumer to condensed milk richer in butter fat.

Not unfrequently condensed milk is represented to be nothing more or less than new milk evaporated, at a low temperature, to a certain degree, with the addition of white sugar. None of the five samples analysed by me, however, were produced from whole new milk, but from more or less skimmed milk.

If milk rich in cream is evaporated to a small bulk, even with the greatest care the resulting condensed milk, when mixed with water, draws up oily globules, tastes somewhat rancid, and not so nice and sweet as condensed milk produced from partially skimmed milk.

Really good condensed milk, as a matter of fact, is always made from skim milk, or from milk unusually poor in cream.

In the form of the well-known thick honey-like preparations, condensed sweetened milk is a useful article of food on board ship, or under all circumstances when fresh milk cannot be procured. It certainly is preferable to milk powders, obtained by evaporating skim milk completely to dryness, and with the addition of some sugar, reducing the residue to powder.

However, apart from the greater price of condensed milk, it is not a perfect substitute for new milk, either chemically or physically. At the best, most kinds of good condensed milk are milk-syrups, consisting of concentrated skim milk and white sugar.

MICHIGAN ADULTERATION LAW.

[An Act to prevent and punish the adulteration of articles of food, drink and medicine, and the sale thereof when adulterated.]

SEC. 1. *The people of the State of Michigan enact,*—That no person shall mix, colour, stain, or powder, or permit any other person to mix, colour, stain, or powder any article of food with any ingredient or material so as to render the article injurious to health, with the intent that the same may be sold; and no person shall knowingly sell or offer for sale any such article so mixed, coloured, stained, or powdered.

SEC. 2. No person shall, except for the purpose of compounding in the necessary preparation of medicines, mix, colour, stain, or powder, or order, or permit any other person to mix, colour, stain, or powder any drug or medicine with any ingredient or materials so as to affect injuriously the quality or potency of such drug or medicine, with intent to sell the same, or shall sell or offer for sale any such drug or medicine so mixed, coloured, stained, or powdered.

SEC. 3. No person shall mix, colour, stain or powder any article of food, drink, or medicine, with any other ingredient or material, whether injurious to health or not, for the purpose of gain or profit, or sell or offer the same for sale, or order or permit any other person to sell or offer for sale any article so mixed, coloured, stained, and powdered, unless the same be so manufactured, used, or sold, or offered for sale under its true and appropriate name, and notice that the same is mixed or impure is marked, printed, or stamped upon each package, roll, parcel, or vessel containing the same, so as to be and remain at all times readily visible, or unless the person purchasing the same is fully informed by the seller of the true name and ingredients (if other than such as are known by the common name thereof) of such article of food, drink, or medicine at the time of making sale thereof or offering to sell the same.

Sec. 4. No person shall mix any glucose or grape sugar with syrup, honey, or sugar intended for human food, or any oleomargarine, suine, beef fat, lard, or any other foreign substance, with any butter or cheese intended for human food, or shall mix or mingle any glucose or grape sugar, or oleomargarine with any article of food, without distinctly marking, stamping, or labelling the article, or the package containing the same, with the true and appropriate name of such article, and the percentage in which glucose or grape sugar, oleomargine or suine, enter into its composition; nor shall any person sell, or offer for sale, or order, or permit to be sold, or offered for sale, any such food into the composition of which glucose or grape sugar, or oleomargarine or suine has entered, without at the same time informing the buyer of the fact, and the proportions in which such glucose or grape sugar, oleomargarine or suine has entered into its composition.

Sec. 5. Any person convicted of violating any provision of any of the foregoing sections of this Act shall be fined not more than fifty dollars, or imprisoned in the county jail not exceeding three months.

Sec. 6. It is hereby made the duty of the prosecuting attorneys of this State to appear for the people, and to attend to the prosecution of all complaints under this Act in all the courts in their respective counties.

Sec. 7. All Acts and parts of Acts inconsistent with the provisions of this Act are hereby repealed.

Approved June 10, 1881.

In reference to this law the *Sanitary Engineer* says:—Michigan has been so progressive in sanitary legislation that it is a matter for regret that the Food Adulteration Bill, endorsed by the National Board of Trade, and which was made a law in this State, was not substituted for the one that has been passed. Unlike the law of this State and New Jersey, it gives no definition of adulteration, and provides no means or machinery for the enforcement of the law. No competent body is entrusted with the duty of determining standards of purity, or what article may be properly exempted from the provisions of the law, and under what conditions. We think time will prove it to be unwise to mention in the Act certain articles, as has been done, for such a law should be general, leaving details to be settled by the State Board of Health, which they can do more intelligently than a legislative committee. We fear the only attempts to prosecute under such a law will be made at the instigation of rival business interests, which are more anxious to persecute and drive out competition than to protect the public health. We hope at its next session the legislature of Michigan will pass the same Act this State has done, as a substitute for the imperfect one now on their statute books.

OIL ADULTERATION.

The manager of the Marseilles public laboratory gives the following methods for detecting adulteration in olive with other oils:—Beet root oil contains sulphur, and saponifying the oil with an alcoholic solution of caustic potash will bring out the sulphurous acid. Sesame oil can be found by adding a little muriatic acid to a small piece of sugar, and shaking these along with some of the oil—the sesame oil will be recognized by its red colour. Cottonseed oil has to be treated with nitric acid, and on shaking a coffee-brown *colour* will be seen.

ADULTERATION OF BUTTER WITH TALC.

In a German technological publication—*Dingler's Polytechnische Journal*—it is positively and circumstantially stated that in America butter is adulterated with powdered talc. We have some difficulty in believing this, though such adulteration is just possible, seeing that talc is one of those magnesian minerals which are unctuous or greasy to the touch, like soapstone. If such adulteration is perpetrated, it may be easily detected, by simply melting some of the suspected butter in any glass vessel—a common phial will do, or a lactometer-tube, or a test-tube. If any of this mineral or soapstone, or any other mineral adulterant, is there, it will settle down to the bottom if time is allowed. In order to thus give it time, the phial or tube should be immersed in hot water, and the heat of the water maintained for an hour or two. The application of this simple test by the trade buyers of American butter will do far more to put an end to such adulteration, if it exists, than any spasmodic persecution of small shopkeepers. In all such cases the perpetrators of the adulteration should be punished, not the victims who unknowingly buy it.

ANALYSTS' REPORTS.

At the Berkshire Quarter Sessions the County Analyst reported that 14 samples of food had been submitted to him for analysis during the quarter; four were not genuine. There were nine samples of butter, none of them containing foreign fat—one sample contained 20 per cent. of water; one 19 per cent. of water and 8 per cent. of salt; one 20 per cent. of water, 6 of salt, and 4½ of curd. Two samples of mustard, one of white pepper, and one of arrowroot were genuine. One sample of coffee contained three parts coffee and one part chicory.

At the Cheshire Quarter Sessions, on Monday, the County Analyst (Mr. J. Carter Bell) reported that amongst the samples sent to him for analysis during the past quarter were three of bread, two of pepper, five of mustard, three of tea, four of coffee, two of drugs, two of butter, two of oatmeal, two of flour, three of lard, nine of jam, one sago, one arrowroot; and he did not find that any of these were adulterated.

DEATH OF HENRY JOHN YELD, M.D.

We have the painful duty of recording the death of Dr. H. J. Yeld, the medical officer of health for Sunderland borough and port, on the morning of the 18th November last. Dr. Yeld was one of the most highly esteemed officers in the public health branch of the public service, and he had secured the complete confidence and respect of the corporation and community whom he served in his capacity of health officer. Before his appointment as medical officer of health in 1873, he had held the position of surgeon to the Sunderland Infirmary. He effected suicide by cutting his throat, and the circumstances attending his death have produced the most painful effect in the borough and neighbourhood, where he was so widely known and highly respected. Nothing had been observed to cause any suspicion of the mental change which led to so disastrous a result. Dr. Yeld was an M.D. of St. Andrews, 1862; M.R.C.S. Eng. and L.A.S., 1860; L.M. Glasgow, 1859; and he was educated professionally at Glasgow. He was a Member of the Society of Public Analysts, Fellow of the Chemical and Meteorological Societies, Vice-President of the Northern Counties Association of Medical Officers of Health, and held, besides, the posts of medical officer for the borough and port of Sunderland, public analyst for the borough, physician to the Corporation Hospital, and medical officer to the Life Brigade. "Suicide while in a temporary state of insanity" was the verdict returned by a coroner's jury. Dr. Yeld has left a widow and four children.

THE ANALYSES OF THE PUBLIC WATER SUPPLIES OF ENGLAND.

In compliance with the desire of a large number of those members who are co-operating in this matter, the Council have decided to continue the publication of the analyses for another twelve months, and any Analysts who require further forms of report will receive a supply on sending a post card to that effect to the Secretaries.

SOCIETY OF PUBLIC ANALYSTS.

Analyses of English Public Water Supplies in November, 1881. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Date when drawn.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine in Chlorides.	Phosphoric Acid in Phosphates.	Nitrogen in Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in 15 mins. at 80° Fahr.	Oxygen, Absorbed in 4 hours at 80° Fahr.	Hardness, Clark's Scale, in degrees. Before Boiling.	Hardness, Clark's Scale, in degrees. After Boiling.	Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
Kent Co.	Nov. 22	c. grnsh. yellow	none	1·84	none	·476	·0022	·0032	none	·0040	21·0°	7·0°	34·30	vegetable debris	Wigner & Harland.
New River	" 15	clear	none	1·09	trace	·210	·0007	·0021	·0140	·0280	15·5°	3·0°	21·84	satisfactory	B. Dyer.
East London ..	" 16	s. turb. br. grn.	slight	1·91	none	·421	·0032	·0066	·0240	·0580	16·1°	6·1°	25·60	vegetable debris	Wigner & Harland.
Southwark & Vauxhall ..	" 8	c. f. yellow	none	1·24	trace	·170	none	·0077	·0504	·0728	14·0°	3·5°	19·88	satisfactory	J. Muter.
West Middlesex	" 5	greenish yellow	none	1·15	trace	·136	·0011	·0055	·0460	·0980	13·8°	2·8°	20·33	satisfactory	O. Hehner.
Grand Junction	" 14	p. straw colour		1·08	trace	·168	none	·0065	·0237	·0964	15·0°	4·2°	21·50	satisfactory	A. Wynter-Blyth.
Lambeth	" 8	c. f. yellow	none	1·24	trace	·170	none	·0070	·0448	·0560	14·0°	3·5°	19·60	satisfactory	J. Muter.
Chelsea	" 15	c. grnsh. yellow	none	1·26	trace	·140	none	·0080	·0500	·0810	16·0°	4·5°	22·40	none	A. Dupré.
Bath	Nov. 18	clear f. blue	none	·91	none	·150	none	·0002	none	none	17·0°	4·5°	22·80	diatoms carb. lime	J. W. Gatehouse.
Bradford	" 16	s. opq. pty. yell.	none	·60	none	none	none	·0049	·0530	·1400	3·6°	3·4°	7·90	none	F. M. Rimmington.
Birmingham ..	" 7	grnsh. and turb.	none	1·40	traces	·185	·0028		·0390	·1070	10·9°	6·2°	19·46	vegetable forms	A. Hill.
Bolton	" 12	v. turbid yellow	none	·45	none	·038	·0019	·0061	·0268	·0426	3·2°	3·0°	7·12	mineral and veg. matter	W. H. Watson.
Brighton	" 11	c. green blue	none	1·98	traces	·472	·0019	·0020	none	·0060	13·2°	4·4°	22·00	vegetable debris	Wigner & Harland.
Bristol	" 7	p. brnsh. green	none	·85	none	·129	·0001	·0029	·0196	·0564	14·5°	1·7°	18·40	v. slight sand	F. W. Stoddart.
Bury (Lan.) ..	" 14	s. turbid yellow	s. mossy	·84	none	·048	·0043	·0086	·0200	·0333	4·5°	4·4°	7·88	mineral and veg. matter	W. H. Watson.
Cambridge	" 16	c. pale blue	none	1·33	traces	·461	·0005	·0015	none	·0140	17·5°	5·5°	24·00	satisfactory	J. West Knights.
Canterbury	" 18	c. pale blue	none	1·47	none	·336	·0005	·0006	·0040	·0060	8·6°	4·3°	11·76	s. carb. lime	S. Harvey.
Croydon	" 17	c. b. colourless	none	1·26	traces	·268	none	·0030	·0066	·0066	16·5°	7·0°	22·60	none	C. Heisch.
Darlington	" 14	v. yellow green	peaty	·70	trace	·034	·0007	·0028	·1726	·2613	6·5°	4·5°	8·40	satisfactory	W. F. K. Stock.
Edinburgh	" 18	s. brown	none	·67	none	traces	·0024	·0064	·0160		4·2°	3·9°	5·84	none	J. Falconer King.
Exeter	" 10	f. brnsh. yellow	none	·84	trace	·219	·0018	·0031		·0756	2·8°	2·8°	6·30		F. P. Perkins.
Grantham	" 5	c. greenish	none	1·05	trace	·530	·0016	·0027	·0156	·0235	14·6°	4·5°	23·57	diatoms and veg. debris	A. Ashby.
Hastings	" 15	clear blue	none	4·70	trace	·020	none	·0035	·0020	·0084	10·5°	7·5°	26·40	none	H. F. Cheshire
Ipswich	" 14	colourless	none	2·24	trace	·207	·0049	·0025	none	·0080	19·0°	8·5°	30·12	satisfactory	J. Napier.
King's Lynn ..	" 2	drty. mlky. whte.	faint	1·59	traces	·322	·0022	·0084	·0232	·4372	17·5°	5·0°	21·98	mov. orgns. dec. veg. mtr.	W. Johnstone.
Leicester	" 19	v. s. yellow	none	1·30	traces	·078	·0015	·0037	·0146	·0755	7·7°	5·3°	14·30	satisfactory	W. L. Emmerson.
Liverpool	" 16	yellow brown	s. peaty	1·08	traces	·052	·0028	·0082	·0358	·0728	4·8°	3·7°	8·54		A. Smetham.

SOCIETY OF PUBLIC ANALYSTS.

Analyses of English Public Water Supplies in November, 1881. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Date when drawn.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine in Chlorides.	Phosphoric Acid in Phosphates.	Nitrogen in Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in: 15 mins. at 80° Fahr.	Oxygen, Absorbed in: 4 hours at 80° Fahr.	Hardness, Clark's Scale, in degrees: Before Boiling.	Hardness, Clark's Scale, in degrees: After Boiling.	Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
Maidstone—															
Wtr. Company	Nov. 11	green	none	2·93	trace	·576	none	·0023	·0145	·0182	18·0°	5·8°	35·42	none	M. A. Adams.
Public Conduit	" 11	v. light blue	none	2·33	trace	·576	none	·0008	·0036	·0075	17·1°	5·8°	31·57	none	M. A. Adams.
Manchester....	" 16	c. f. yellowish	none	·74	none	none	·0030	·0051	·0228	·0915	2·0°	1·8°	4·22	s. mineral	W. Thomson.
Newark	" 11	c. blsh green	none	1·42	trace	·040	·0017	·0043	·0247	·0463	18·0°	14·0°	37·63	satisfactory	A. Ashby.
Newcastle-on-Tyne......	" 8	f. yellow	none	·81	trace	·040	·0010	·0090	·0710	·1130	16·8°	6·5°	20·00	satisfactory	J. Pattinson.
Norwich	" 9	p. grnsh. yellow	none	1·85	trace	·048	traces	·0088	·0340	·0826	12·2°	3·7°	15·60	satisfactory	W. G. Crook.
Nottingham ..	" 15	grnsh. blue	slight	2·20	none	1·930	none	·0039	none	·0060	17·0°	10·6°	34·20	vegetable debris	Wigner & Harland
Portsmouth ..	" 14	s. turbid	none	1·12	trace	·230	trace	·0050	none	none	16·6°	2·0°	18·50	dec. veg. debris, diatoms	W. J. Sykes.
Reading	" 10	c. f. greenish	none	·85	none	·075	·0005	·0042	none	·0350	13·0°	3·8°	17·50	satisfactory	J. Shea.
Rochdale	" 19	pale blue	none	·60	none	·030	·0014	·0014	·0140	·0420	2·5°	2·5°	5·00	satisfactory	T. A. Collinge.
Rugby	" 4	f. turbid	none	1·28	h. traces	·152	·0042	·0119	·0175	·0308	10·7°	8·6°	16·80	veg. deb., diats., bacteria	A. P. Smith.
Salford	" 1	c. bright yellow	none	·70	none	none	·0014	·0350	·0028	·0420	3·0°	2·5°	5·00	none	J. Carter Bell.
Sevenoaks	" 15	clear	none	1·40	trace	·341	·0007	·0012	trace	·0110	12·0°	3·0°	18·48	satisfactory	B. Dyer
Swansea	" 16	clear	none	·80	trace	none	·0010	·0056	·0040	·0040	1·5°	1·5°	3·78	none	W. Morgan.
Southampton ..	" 18	grnsh. yellow	none	1·00	h. trace	·470	trace	·0044	·0220	·0800	12·5°	4·5°	19·60	satisfactory	A. Angell.
Shrewsbury ..	" 7	c. colourless	none	1·45	none	·280	·0015	·0055	·0040	·0040	22 0°	6·0°	24·00	none	T. P. Blunt.
Warwick	" 16	greenish	none	1·33	none	·126	·0007	·0049	·0240	·0540	19·2°	13·0°	23·10	none	A. Bostock Hill.
Whitehaven ..	" 3	c. f. green	none	·35	none	·007	none	·0010	·0069	·0170	·4°	·4°	1·96	satisfactory	A. Kitchin.
Wolverhampton	" 14	s. yellow brown	none	1·33	trace	·126	none	·0049	·0392	·0814	13·7°	6·7°	21·56	veg. spores & deb., diats.	E. W. T. Jones.
Philadelphia U.S.A.—															
Schuylkill Wtr.	Septr.			·65	none	·0430	none	·0056					12·60		H. Leffmann.
Delaware Wtr.	"			1·31	traces		·0018	·0140					11·60		H. Leffmann.

Abbreviations:—c., clear; f., faint; h., heavy; p., pale; v. h., very heavy; v. s., very slight.

SOCIETY OF PUBLIC ANALYSTS.

Analyses of English Public Water Supplies in November, 1881. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Date when drawn.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine in Chlorides.	Phosphoric Acid in Phosphates.	Nitrogen in Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in: 15 mins. at 80° Fahr.	Oxygen, Absorbed in: 4 hours at 80° Fahr.	Hardness, Clark's Scale, in degrees: Before Boiling.	Hardness, Clark's Scale, in degrees: After Boiling.	Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
Kent Co.	Nov. 22	c. grnsh. yellow	none	1·84	none	·476	·0022	·0032	none	.0040	21·0°	7·0°	34·30	vegetable debris	Wigner & Harland.
New River	„ 15	clear	none	1·09	trace	·210	·0007	·0021	·0140	·0280	15·5°	3·0°	21·84	satisfactory	B. Dyer.
East London ..	„ 16	s. turb. br. grn.	slight	1·91	none	·421	·0032	·0066	·0240	·0580	16·1°	6·1°	25·60	vegetable debris	Wigner & Harland.
Southwark & Vauxhall ..	„ 8	c. f. yellow	none	1·24	trace	·170	none	·0077	·0504	·0728	14·0°	3·5°	19·88	satisfactory	J. Muter.
West Middlesex	„ 5	greenish yellow	none	1·15	trace	·136	·0011	·0055	·0460	·0980	13·8°	2·8°	20·33	satisfactory	O. Hehner.
Grand Junction	„ 14	p. straw colour		1·08	trace	·168	none	·0065	·0237	·0964	15·0°	4·2°	21·50	satisfactory	A. Wynter-Blyth.
Lambeth	„ 8	c. f. yellow	none	1·24	trace	·170	none	·0070	·0448	·0560	14·0°	3·5°	19·60	satisfactory	J. Muter.
Chelsea	„ 15	c. grnsh. yellow	none	1·26	trace	·140	none	·0080	·0500	·0810	16·0°	4·5°	22·40	none	A. Dupré.
Bath	Nov. 18	clear f. blue	none	·91	none	·150	none	·0002	none	none	17·0°	4·5°	22·80	diatoms carb. lime	J. W. Gatehouse.
Bradford	„ 16	s. opq. pty. yell.	none	·60	none	none	none	·0049	·0530	·1400	3·6°	3·4°	7·90	none	F. M. Rimmington.
Birmingham ..	„ 7	grnsh. and turb.	none	1·40	traces	·185	·0028		·0390	·1070	10·9°	6·2°	19·46	vegetable forms	A. Hill.
Bolton........	„ 12	v. turbid yellow	none	·45	none	·038	·0019	·0061	·0268	·0426	3·2°	3·0°	7·12	mineral and veg. matter	W. H. Watson.
Brighton	„ 11	c. green blue	none	1·98	traces	·472	·0019	·0020	none	·0060	13·2°	4·4°	22·00	vegetable debris	Wigner & Harland.
Bristol........	„ 7	p. brnsh. green	none	·85	none	·129	·0001	·0029	·0196	·0564	14·5°	1·7°	18·40	v. slight sand	F. W. Stoddart.
Bury (Lan.) ..	„ 14	s. turbid yellow	s. mossy	·84	none	·048	·0043	·0086	·0200	·0333	4·5°	4·4°	7·88	mineral and veg. matter	W. H. Watson.
Cambridge	„ 16	c. pale blue	none	1·33	traces	·461	·0005	·0015	none	·0140	17·5°	5·5°	24·00	satisfactory	J. West Knights.
Canterbury	„ 18	c. pale blue	none	1·47	none	·336	·0005	·0006	·0040	·0060	8·6°	4·3°	11·76	s. carb. lime	S. Harvey.
Croydon	„ 17	c. b. colourless	none	1·26	traces	·268	none	·0030	·0066	·0066	16·5°	7·0°	22·60	none	C. Heisch.
Darlington	„ 14	v. yellow green	peaty	·70	trace	·034	·0007	·0028	·1726	·2613	6·5°	4·5°	8·40	satisfactory	W. F. K. Stock.
Edinburgh	„ 18	s. brown	none	·67	none	traces	·0024	·0064	·0160		4·2°	3·9°	5·84	none	J. Falconer King.
Exeter........	„ 10	f. brnsh. yellow	none	·84	trace	·219	·0018	·0031		·0756	2·8°	2·8°	6·30		F. P. Perkins.
Grantham	„ 5	c. greenish	none	1·05	trace	·530	·0016	·0027	·0156	·0235	14·6°	4·5°	23·57	diatoms and veg. debris	A. Ashby.
Hastings	„ 15	clear blue	none	4·70	trace	·020	none	·0035	·0020	·0084	10·5°	7·5°	26·40	none	H. F. Cheshire
Ipswich	„ 14	colourless	none	2·24	trace	·207	·0049	·0025	none	·0080	19·0°	8·5°	30·12	satisfactory	J. Napier.
King's Lynn ..	„ 2	drty. mlky. whte.	faint	1·59	traces	·322	·0022	·0084	·0232	·4372	17·5°	5·0°	21·98	mov. orgns. dec. veg. mtr.	W. Johnstone.
Leicester......	„ 19	v. s. yellow	none	1·30	traces	·078	·0015	·0037	·0146	·0755	7·7°	5·3°	14·30	satisfactory	W. L. Emmerson.
Liverpool	„ 16	yellow brown	s. peaty	1·08	traces	·052	·0028	·0082	·0358	·0728	4·8°	3·7°	8·54		A. Smetham.

SOCIETY OF PUBLIC ANALYSTS.

Analyses of English Public Water Supplies in November, 1881. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Date when drawn.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine in Chlorides.	Phosphoric Acid in Phosphates.	Nitrogen in Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in 15 mins. at 80° Fahr.	Oxygen, Absorbed in 4 hours at 80° Fahr.	Hardness, Clark's Scale, in degrees. Before Boiling.	Hardness, Clark's Scale, in degrees. After Boiling.	Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
Maidstone—															
Wtr. Company	Nov. 11	green	none	2·93	trace	·576	none	·0023	·0145	·0182	18·0°	5·8°	35·42	none	M. A. Adams.
Public Conduit	" 11	v. light blue	none	2·33	trace	·576	none	·0008	·0036	·0075	17·1°	5·8°	31·57	none	M. A. Adams.
Manchester....	" 16	c. f. yellowish	none	·74	none	none	·0030	·0051	·0228	·0915	2·0°	1·8°	4·22	s. mineral	W. Thomson.
Newark	" 11	c. blsh green	none	1·42	trace	·040	·0017	·0043	·0247	·0463	18·0°	14·0°	37·63	satisfactory	A. Ashby.
Newcastle-on-Tyne......	" 8	f. yellow	none	·81	trace	·040	·0010	·0090	·0710	·1130	16·8°	6·5°	20·00	satisfactory	J. Pattinson.
Norwich	" 9	p. grnsh. yellow	none	1·85	trace	·048	traces	·0088	·0340	·0826	12·2°	3·7°	15·60	satisfactory	W. G. Crook.
Nottingham ..	" 15	grnsh. blue	slight	2·20	none	1·930	none	·0039	none	·0060	17·0°	10·6°	34·20	vegetable debris	Wigner & Harland
Portsmouth ..	" 14	s. turbid	none	1·12	trace	·230	trace	·0050	none	none	16·6°	2·0°	18·50	dec. veg. debris, diatoms	W. J. Sykes.
Reading	" 10	c. f. greenish	none	·85	none	·075	·0005	·0042	none	·0350	13·0°	3·8°	17·50	satisfactory	J. Shea.
Rochdale	" 19	pale blue	none	·60	none	·030	·0014	·0014	·0140	·0420	2·5°	2·5°	5·00	satisfactory	T. A. Collinge.
Rugby	" 4	f. turbid	none	1·28	h. traces	·152	·0042	·0119	·0175	·0308	10·7°	8·6°	16·80	veg. deb., diats., bacteria	A. P. Smith.
Salford	" 1	c. bright yellow	none	·70	none	none	·0014	·0350	·0028	·0420	3·0°	2·5°	5·00	none	J. Carter Bell.
Sevenoaks	" 15	clear	none	1·40	trace	·341	·0007	·0012	trace	·0110	12·0°	3·0°	18·48	satisfactory	B. Dyer
Swansea	" 16	clear	none	·80	trace	none	·0010	·0056	·0040	·0040	1·5°	1·5°	3·78	none	W. Morgan.
Southampton ..	" 18	grnsh. yellow	none	1·00	h. trace	·470	trace	·0044	·0220	·0800	12·5°	4·5°	19·60	satisfactory	A. Angell.
Shrewsbury ..	" 7	c. colourless	none	1·45	none	·280	·0015	·0055	·0040	·0040	22 0°	6·0°	24·00	none	T. P. Blunt.
Warwick	" 16	greenish	none	1·33	none	·126	·0007	·0049	·0240	·0540	19·2°	13·0°	23·10	none	A. Bostock Hill.
Whitehaven ..	" 3	c. f. green	none	·35	none	·007	none	·0010	·0069	·0170	·4°	·4°	1·96	satisfactory	A. Kitchin.
Wolverhampton	" 14	s. yellow brown	none	1·33	trace	·126	none	·0049	·0392	·0814	13·7°	6·7°	21·56	veg. spores & deb., diats.	E. W. T. Jones.
Philadelphia U.S.A.—															
Schuylkill Wtr.	Septr.			·65	none	·0430	none	·0056					12·60		H. Leffmann.
Delaware Wtr.	"			1·31	traces		·0018	·0140					11·60		H. Leffmann.

Abbreviations:—c., clear; f., faint; h., heavy; p., pale; v. h., very heavy; v. s., very slight.

THE PUBLIC WATER SUPPLIES OF ENGLAND.

VALUATION, ACCORDING TO "WIGNER'S VALUATION SCALE," OF THE ANALYSES PUBLISHED THIS MONTH.

In the following table we give the *average* valuation of those public water supplies reported on this month from January to June, and the valuation of the July, August, September, October, and November waters.

	Average to June.	July.	August.	Sept.	October.	November.
London— Kent	30	27	20	27	29	26
New River	26	17	17	21.	24	25
East London	32	39	20	28	35	46
Southwark and Vauxhall	34	28	31	27	30	43
West Middlesex	30	24	29	39	33	43
Grand Junction	30	23	25	30	31	36
Lambeth	37	29	31	26	33	37
Chelsea	30	26	32	36	37	43
Bath	12	19	20	..	13	16
Birmingham	33	37	26	29	36	47
Bolton	..	17	19	17	28	29
Bradford	53	53	59	44	36	31
Brighton	24	23	25	21	22	25
Bristol	22	27	..	30	29	24
Bury	..	35	24	24	30	33
Cambridge	28	26	22	21	22	22
Canterbury	17	22	16	12	15	13
Croydon	27	30	..	..	22	21
Darlington	33	39	96	50	74	62
Derby	18	13	..	..	..	..
Dublin	23	..	13	..	..	..
Edinburgh	28	21	20	24	31	28
Exeter	20	16	23	23	18	23
Grantham	27	..	32	..	70	30
Hastings	..	20	25	..	27	25
Huddersfield	23	26	28	..	..	..
Ipswich	27	30	30	..	28	25

	Average to June.	July.	August.	Sept.	October.	November.
King's Lynn	94	110	48	110	84	128
Leamington	26	..	26	..	24	..
Leeds	35	28	22	..	..	..
Leicester	42	24	26	23	25	27
Liverpool	36	29	41	47	37	31
Maidstone— Water Company	39	34	30	31	38	35
,, Public Conduit	36	28	25	27	31	27
Manchester	22	17	29	28	49	27
Newark	39	46	41	..	33	34
Newcastle-on-Tyne	37	40	43	68	57	55
Norwich	36	49	36	33	34	38
Nottingham	39	46	38	42	62	55
Plymouth	29	..	..	28	..	..
Portsmouth	30	22	26	27	24	29
Reading	25	20	34	23	25	18
Rochdale	9	7	9	..	5	12
Rugby	41	..	..	46	69	55
Salford	18	14	21	21	15	14
Sevenoaks	20	..	..	..	..	20
Shrewsbury	23	..	17	19	21	25
Southampton	43	..	40	40	40	37
Sunderland	25	27	..	..	..	..
Swansea	16	14	19	15	12	12
Tunbridge Wells	..	..	..	35	..	..
Warwick	34	34	..	40	..	40
Whitehaven	9	17	14	10	10	7
Wolverhampton	46	39	32	15	33	41

Owing to considerations of space we have omitted from this table those places as to which we have published no analyses during the past four months.

In the case of the Metropolitan waters, the average valuation of the supplies for November show an increase of 6 over the valuation for October, but the increase is almost entirely in the supplies of the companies drawing from the rivers Thames and Lea. The Kent water shows a slight though not notable improvement, the New River water an increase in the valuation of only one, while the other companies have increases ranging from 4 in

Lambeth to 13 in Southwark and Vauxhall. These waters, however, cannot even with this increased valuation be considered as really second class.

Among the provincial supplies reported on this month the most pure are Whitehaven with a valuation of 7, Rochdale and Swansea 12 each, Canterbury 13, Salford 14, Bath 16, Reading 18, and Sevenoaks 20.

These results show scarcely any notable changes from last month's—in fact these pure supplies have not yet appeared to have that slight amount of winter contamination which we presume is to be expected in them as well as in the slightly less pure waters.

Following these best waters we have Croydon with a valuation of 21, Cambridge 22, Exeter 23, Brighton, Hastings, Ipswich, and Shrewsbury 25 each, Leicester, Maidstone Public Conduit, and Manchester 27 each, Edinburgh 28, Bolton and Portsmouth 29 each, and Grantham 30. The only changes of note in these figures are considerable improvement in the Manchester and Grantham supplies, which in both cases is almost entirely due to a large reduction in the amount of oxygen absorbed.

The valuations of Bradford, Darlington, Liverpool, Maidstone Water Company, Newcastle, Nottingham, Rugby, Southampton, show an improvement over the valuations of last month, while on the other hand the analyses of the waters of Birmingham, Bury, King's Lynn, Newark, Norwich, Portsmouth, and Wolverhampton give less satisfactory indications. The usual winter deterioration does not, however, appear to be on the whole quite as marked this month.

INTERNATIONAL FOOD EXHIBITION, 1881.

The following is the Report made by the Judges—H. C. Bartlett, Ph.D., F.C.S.; G. W. Wigner, F.C.S., F.I.C.; J. Milner Fothergill, M.D.; J. Danford Thomas, M.D.; at the Food Exhibition held at the Agricultural Hall during the first fortnight in November:—

The exhibits of this year show in many respects a great improvement over those of last year. There is little increase in the variety of food staples shown, but in most cases greater attention appears to have been paid to the purity and quality of the goods exhibited.

Tinned foods necessarily occupy a very important place in the Exhibition. The display of them this year is as prominent as heretofore. We have carefully tested these goods for quality, and are of opinion that every care is being taken to maintain the highest known standards, as well as to bring out novelties of superior quality. There are certain difficulties supposed to be inseparable from the process of canning meat, fruits, and vegetables; but noteworthy improvements have been made by the packing companies.

Several new inventions have been submitted to us which show that those who are most familiar with the subject are giving their attention to this matter, and, although we cannot say that the difficulties in question have been altogether overcome, yet there has been a marked advance since last year. Tinned goods must come more and more into use; and for this reason it becomes essential to watch closely the character of the articles which are being sent to this country.

We are more dependent than ever on the United States and Canada for cereals, and the exhibits on this occasion are of a high class. There are nearly twenty different

preparations of maize, all of which are easily rendered available for the table, while several other cereals are suitably prepared; but some would be improved by the separation of the husk before being packed.

The English preserved meats, jams, &c., that are shown are of the highest quality that have ever been presented to our notice. It would be invidious to draw special attention to any one exhibit, except so far as has been done by the awards given.

It is extremely satisfactory to find that pickles and jams, perfectly genuine, and of the highest quality, are offered for sale at prices which are comparable with those ordinarily paid.

As regards the ærated waters and other "temperance" drinks, we have analysed every beverage exhibited, and they are all non-alcoholic. The flavour of these "temperance" beverages shows, in many instances, a very marked improvement; and in most cases there is no excess of medicinal constituents, the flavour being now due to fruit extracts instead of to objectionable artificial essences.

Genuine cocoas and chocolates are more conspicuous than before. We note with satisfaction the increased use of pure cocoa.

There are valuable exhibits of Australian and other colonial wines, which are of importance as showing what our colonies can do in this class of produce.

Tea is well represented, and we can speak with satisfaction of the samples shown.

The exhibits of cooking stoves are not as numerous as might have been expected, but we are favourably impressed with the character of those shown, and especially of some gas stoves.

The dough and kneading machinery exhibited is well designed.

All the Foods specially put forward for infants fall short in those soluble nutritive matters which are essential. These foods are all too starchy.

The Silver and Bronze Medals and the Certificates of Honourable Mention have been awarded as much for the general character of the exhibits, as for their purity or excellence in their respective classes.

Some exhibits would have received higher awards had their importance equalled the peculiar merits of the articles shown.

The following extract from the list of awards may be of interest to our readers:—

SILVER MEDALS.

Davis, H. & C., & Co., 200, Camberwell Road, S.E., for Gas Cooking Apparatus.

Challen, D., 121, Mildmay Road, N., for Vanilla, Flavouring Essences, and Wilson's American Biscuits.

Anglo-Swiss Condensed Milk Co., 10, Mark Lane, for Condensed Milk.

Dunn & Hewett, Pentonville Road, for Rock Cocoa and Manufactured Chocolate.

Thurber, H. K. & F. B., 9 and 11, Fenchurch Avenue, E. C., for Cereal Products.

Thurber, H. K. & F. B., for Canned Meats.

Evans, Sons & Co., Hanover Street, Liverpool, for Lime Fruit Preparations and Lime Juice Sauce.

Vin-Santé Co., for Orange and Tonic Champagne and Vin-Santé.

Aylesbury Dairy Co., St. Petersburgh Place, Bayswater, W., for Peptonised Milk and Koumiss.

Tulloch, W., & Son, 26 and 27, Bury Street, St. Mary Axe, E.C., for Pure Dutch Cocoa.

Zoedone Company, Wrexham, for Zoedone, dry and sans sucre.

Burgess, J., & Sons, 107, Strand, for Preserved Anchovies, Sauces, and Pickles.

Beach, T. W., Old Brentford, for Genuine Jams.

Maignen, P. A., 22 and 23, Great Tower Street, E.C., for Improved Application of the "Filtre Rapide."

BRONZE MEDALS.

Brand & Co., 11, Little Stanhope Street, W., for Albuminous and other Concentrated Extracts of Meat.
Chemists' Aerated and Mineral Water Association, Limited, 45, Gifford Street, N., for B. P. Aerated Waters.
Begg, J. & Co., Manchester Road, Bolton, for Chili Moselle, Ginger Ale, and Lemonade.
Bellis, T. K., Jeffrey's Square, E.C., for Sun-dried Turtle and Turtle Soup.
Skinner, G. H., 13, North Street, Exeter, for Quinine Sparkling Tonic, and Orange Champagne.
Delacre's Extract of Beef Company, 48, King William Street, E.C., for Extract of Beef.
Savory & Moore, 143, New Bond Street, W., for Pharmaceutical Preparations.
Lehmann & Co , 106, Fenchurch Street, E.C., for "Aventicum" Condensed Milk.

HONOURABLE MENTION.

Noble & Co., 3, Savage Gardens, Tower Hill, E.C. for Bjorkboni's Malt Extract (simplex.)
Chollett & Co., 134, Fenchurch Street, E.C., for Dried and Compressed Vegetables for Soups.
Feltoe & Sons, 27, Albemarle Street, W., for "Specialité" Lime Juice.
Goundry & Co., 181, Upper Thames Street, E.C., for Consolidated Tea.
Gulliver, S., & Co., Vale of Aylesbury, for Whiskey Curaçoa and Aerated Waters.

SPONTANEOUS COMBUSTION BY NITRIC ACID.

In consequence of the burning of a car during the fall of 1879 on one of the railways in Baden, which was suspected to have been caused by nitric acid, Professor R. Haas, of Carlsruhe, was called upon by the government to report whether that acid could produce combustion or not. In the experiments made to solve this question, the conditions which might be supposed to exist in freight cars containing nitric acid were imitated as far as possible. Small boxes of a capacity of ten to sixteen quarts were charged with variable proportions of hay, straw, tow, and blotting-paper—all of which substances are used in packing—and placed within larger boxes, while the space between them was filled with hay or tow, to prevent too rapid a radiation of heat, because the experiments were to be conducted in the open air, and the outer box at the same time represented the walls of a railway car. The material contained in the inner box was now saturated with acid, and rather tightly compressed, so that when the cover was put on it was pretty well filled. At first reddish and afterwards whitish vapours were given off, finally a distinct smoke. On lifting the cover strongly glowing patches could be seen, which rapidly increased all through the contents, and which broke out in bright flames on access of free air or gentle fanning. With red fuming acid, or with acid of specific gravity 1·48, these results were obtained very rapidly and within a few minutes. With ordinary acid, of specific gravity 1·395, it required somewhat more time, and the action was less energetic in the beginning; but, in three different trials, after about twenty minutes, the same result was finally obtained, provided the material was packed tightly in the box, and was thoroughly saturated in its successive layers.

CORRESPONDENCE.

[The Editors are not responsible for the opinions of their Correspondents.]

PHOSPHORIC ACID DETERMINATIONS.

To the Editor of "The Analyst."

Sir,—May I be permitted to draw attention to a little matter connected with the Instructions for Water Analysis compiled by the Water Committee of the Society of Public Analysts.

In determining the phosphoric acid qualitatively, they direct that strong nitric acid is to be added to the residue in the platinum basin, and then evaporated to dryness, &c. Now I have observed that if this is done a little platinum is dissolved whenever there is a notable quantity of chlorides in the residue. This is undesirable for two reasons. Firstly,—because our platinum basins will gradually

become vanishing quantities, in fact I have noticed that mine have lost weight more rapidly since I have pursued this plan; and secondly, because the platinic chloride formed imparts a yellow tinge to the solution before the molybdic solution is added, and therefore a trace of phosphoric acid may be assumed to be present whether it is there or not. Although this would not be of much consequence with some waters—as for instance with those derived from Oolitic formations, which I believe always contain a faint trace of it, yet in others it would interfere with scientific accuracy.

In order to avoid this possible source of fallacy, I would suggest that after the strong nitric acid has been added to the residue in the platinum basin, it should always be transferred to a porcelain one before it is evaporated to dryness. There would be no chance of missing any trace of phosphoric acid, as phosphates are so readily soluble in the acid.

I am, Sir,

Your obedient Servant,

Grantham, Nov. 17th, 1881. ALFRED ASHBY.

ESTIMATION OF TANNIN IN TEA.

To the Editor of "The Analyst."

Sir,—Since the publication of my paper in June last on the Estimation of Tannin in Tea, I have made further examinations of a similar kind on thirty other samples of tea, the results of which are appended. They go far to show that there are many exceptions to the rule, if it be one, that Green Teas contain more Tannin than Black Teas.

RESULTS OF TEA ANALYSES.

Description.	Ash Total.	Ash Soluble.	Ash Insoluble.	Tannin.	Extract.
Black Tea	5·67	3·07	2·60	22·75	37·0
"	5·79	3·39	2·40	17·23	31·7
"	6·45	3·05	3·40	23·73	37·5
"	5·84	2·64	3·20	17·23	30·5
"	6·26	3·21	3·05	11·70	30·9
"	5·99	2·99	3·00	11·05	33·8
Green Tea	6·19	3·79	2·40	9·1	38·0
"	7·39	4·29	3·10	7·48	35·0
"	5·99	3·90	2·09	6·18	33·5
"	6·89	3·44	3.45	7·48	33·2
"	6·64	3·09	3·55	7·15	33·5
"	5·94	4·24	1·70	17·55	32·7
Black Tea	6·74	3·14	3·60	17·25	23·4
"	5·86	3·43	2·43	18·85	30·2
"	6·38	3·10	3·28	16·58	30·6
"	6·47	3·33	3·14	23·20	35·7
"	5·94	3·44	2·50	27·30	39·6
"	6·06	3·36	2·70	24·70	33·6
Green Tea	6·06	4·16	2·90	23·40	37·6
"	5·84	4·19	1·65	23·11	35·4
"	6·39	4·66	1·73	25·35	38·1
"	6·77	3·17	3·60	22·72	34·2
"	7·06	3·61	3·45	19·18	30·7
"	6·21	3·86	2·35	20·15	31·6
Black Tea	6·31	3·54	2·77	27·61	39·0
"	6·05	3·42	2·63	19·17	31·6
"	6·48	3·80	2·68	26·97	38·3
"	6·80	3·79	3·01	24·70	35·8
"	5·93	3·24	2·69	21·41	33·2
"	6·18	3·40	2,78	27·31	40·4
Averages.. ..	6·28	3·52	2·76	18·92	34·2

In reference to the actual titration by permanganate, which may be carried out either in a beaker or in a porcelain dish, I wish to state that after considerable experience I have come to the conclusion that the dish is preferable, as the faint rose tint indicative of the excess of permanganate, which shows on the white background at the edge of the liquid, admits of more ready detection than does the clear yellow colour of the whole volume of liquid in the beaker.

It may be mentioned in regard to this excellent process that the improvement in Löwenthal's original method is largely based on the suggestion of Mr. C. Estcourt, in a paper contributed to the *Chem. News*, Vol. XXIX., p. 109, to precipitate the tannin with gelatine, and to titrate the solution with potassium permanganate both before and after such precipitation, using indigo as indicator.

I remain,

Yours faithfully,

ALFRED HILL, M.D., F.I.C.

PUBLIC ANALYSTS' APPOINTMENTS.

To the Editor of "The Analyst."

Sir,—On my appointment as Public Analyst to the City of Worcester, the terms of agreement included the analysis of water forwarded to me by certain city officials. This autumn I was requested by the city surveyor to analyse four samples of sewage effluents taken from the county of Gloucester. Not considering a sewage effluent to be water, nor Gloucestershire to be included in the city of Worcester, I sent in an account of extra fees. The Town Council decided that sewage and effluents were water, and that the locality they came from made no difference, so that I was obliged to agree to their analyses as part of my ordinary duties. I thought it well to send you this information that other analysts may take care that the terms of their appointments do not bring upon them heavy extra duties without pay.

Yours faithfully,

HORACE SWETE, M.D.,

Analyst City of Worcester, &c.

45, Foregate Street, Worcester, Nov. 25th, 1881.

Extract from Terms of Appointment.

"2.—The 40 Analyses above-mentioned shall include the analysis, once in every three months, of the Water supplied from the City Water-works, and also, once in every three months, of the Gas supplied from the Worcester Gas-works; but the Analyst shall not be required to make any analysis of the Gas until the Council of the said City shall think fit to provide the requisite apparatus. The said 40 Analyses shall also include such Articles of Food and Drugs and such Water as shall be submitted to the Analyst by the Medical Officer of Health, the Inspector of Nuisances, or the Inspector of Weights and Measures of the said City, or by any other person authorised by the Council or the General Health Committee. Every Analysis after the first 40 so submitted shall be paid for at the rates above-mentioned."

A NEW MANUFACTURE—WATERED LARD.

The following letter appeared in *The Times* recently:—

To the Editor of "The Times."

Sir,—I have this day received the notice below as a fly-leaf to a trade circular. It is well the public should have their attention called to it, so that they may be on their guard as to what they really are purchasing.

Yours faithfully,

November 13th, 1881. FAIR-DEALING.

"Watered lard being now used extensively, owing to the high price of the pure quality, we are giving our special attention to its manufacture, and shall be pleased to send samples and prices if you are buyers."

[In our law reports will be found a case in which a shopkeeper was convicted for selling this watered lard.—Ed. Analyst.]

LAW REPORTS.

Convictions for Refusing to Serve Inspector:—

Edward Burgess, milk dealer, Ford Street, Salford, was summoned under the 17th section of the Sale of Food and Drugs Act, for refusing to supply a sample of milk to the inspector when he demanded it. Mr. Walker appeared in support of the summons, and said that this was one of the first prosecutions under the above section, and the offence was undoubtedly a serious one. If he proved the case he should ask the Magistrate to inflict a substantial penalty, in order to strengthen the hands of the inspector. The defence was that the defendant did not sell the milk to the inspector as he did not know what the quality of the milk was which the inspector asked for; but by this time everybody must know that the health department did not wish to act arbitrarily, and that they were willing to assist the milk dealers by taking samples from the people who supplied them with milk. Mr. Gardner defended. Charles Edward Thompson, inspector under the Sale of Food and Drugs Act, said at about half-past ten o'clock on the 13th September he was in the shop of John Henry Stubbs, Ordsal Lane, when the defendant stopped his cart at the door and entered the shop. He asked Mrs. Stubbs how much milk she required, and she said a quart. He got some milk from a can which he had in his cart, and handed it to Mrs. Stubbs. Witness then told the defendant that he required a pint of milk from the can from which he had taken the milk for Mrs. Stubbs, and tendered the price of the milk. Defendant said, "I cannot sell you this, Mr. Thompson, I do not know what it is; I purchased it at the station, and I would not like to sell you it." Witness said that did not matter to him, and told the defendant that he had taken a sample of milk from Mrs. Stubbs, which was not pure, and consequently he had waited for the defendant. Defendant again said he could not let the officer have the milk. Witness did not get the milk, and he and the defendant left the shop together. Witness said, "I suppose you know the consequences of refusing to let me have the milk?" Defendant said, "Yes I know there is a penalty but really I would rather be fined for not selling it to you than I would be fined for selling you something when I did not know whether it was right or not." In cross-examination, the witness said the defendant said he would let him have the milk if he would label it "milk-and-water." He replied that he could not do so, as he had demanded milk. Defendant said he had some of his own farmer's milk and he would let him have some of that. Witness had taken a score of samples from the defendant before, all of which were right. The defence was that the defendant did not sell the milk to the officer, as he had purchased it at the station, and did not know what the quality of it was, and he candidly told the officer this. The Magistrate said if this had been the sort of case he thought it was at first he should have fined the defendant £5 or £10; but as the officer had previously taken a score of samples from the defendant, which had turned out to be right, he should not impose a high penalty. He must, however, show by the fine which he would inflict, that it was a very serious offence when a person refused to sell the inspector a sample of milk from any can out of which he might require it. Defendant was fined 40s. and costs.

George Nicholson, milk dealer, 23, Roland Street, Salford, was summoned for a similar offence. Mr. Walker appeared in support of the summons, and Mr. J. A. Horner (Messrs. Horner & Sons) defended. Inspector Thompson said on the 9th inst. he was on duty in Turnerson Street. He saw the defendant, who was calling out, "Now, ladies, pure, new milk." Witness saw the defendant, who had a horse and cart, sell a pint of milk to a woman named O'Connor. Witness said, "Give me a pint of that pure, new milk, George." He looked round, and then said, "I have none." Witness then demanded the milk, and offered the defendant twopence for it. Defendant said, "I tell you I have none, and that is good enough for you." Defendant began to drive away, whereupon witness told him that if he did not supply him with the milk he should summons him. Defendant said, "You can do what the —— you like," and then drove off. Elizabeth O'Connor gave corroborative evidence. The defence was that the defendant had no milk left when the inspector asked for some. The Magistrate said this was a bad case, and imposed a fine of £5 and costs.

Milk Adulteration:—

At Lambeth, Robert Kent, dairyman, of George Street, Vauxhall, appeared to a summons taken out by Inspector Bott, for the Lambeth Vestry, for selling milk in an adulterated condition. Milk was purchased at the defendant's shop, and upon being tested by Dr. Muter was found to have been adulterated to the extent of 37 per cent. with added water. The defendant had been previously convicted of a similar offence, and fined £3. Mr. Chance said it was a very bad case, and ordered the defendant to pay £5 and 12s. 6d. costs.

William Hedges, dairyman, of 100, Tyer Street, Vauxhall, was summoned also by Inspector Bott for a similar offence. The adulteration in this instance amounted to 18 per cent. of added water, and Mr. Chance imposed a penalty of £2 and 12s. 6d. costs.

At Ramsgate, David Morrison pleaded not guilty to selling milk to the prejudice of the purchaser, not of the nature, quality, or substance demanded, on the 9th August.—Mr. May, in proving the case, said he purchased the milk of defendant on the Sands, and paid him 2½d. for it. The certificate from the analyst showed the milk to be adulterated to the extent of 8 per cent. with added water, and that it contained boracic acid, which witness believed was put in to keep the milk.—Defendant, who stated to the inspector that he bought the milk of Mr. Smith, in Queen Street, now said that all the water found in it came there through putting ice in it overnight to keep it.—Mr. May said he purchased milk of Mr. Smith the same day, and that was pure.—Defendant, who was convicted last year for a similar offence, was now fined 40s. and 10s. costs, or three weeks' imprisonment. The money was paid.

Butter Adulteration :—

At Hungerford, Mr. Giles, grocer, of Kintbury, appeared on the information of Inspector Whinchcombe, charged with having, on September 23rd, sold for butter a substance which was not butter. Stephen Chapman, an inspector under the Food and Drugs Act, stated that on the day in question he went to the defendant's shop and purchased half a pound of butter from defendant's daughter. He asked for the proprietor, and on Mr. Chapman coming forward he told him that the butter just purchased would be sent to the Public Analyst to be analysed. This the witness had done, and the analyst's report stated that the article in question contained 20 per cent. of water, instead of 10 per cent. as allowed. Defendant said he bought the article for butter from Mr. Allen. It had not since been tampered with, and was in the same state as he bought it, a statement his daughter corroborated. It had been retailed at 1s. 2d. per lb., which was only a fair profit, and his customers had made no complaint. He had received no warranty with it when bought. Mr. Allen deposed to having sold the butter, which he believed to be in the same state as when sold to the defendant. Witness had bought it of Messrs. Symes, of Bristol, and he sold it as delivered to him. He had written to the factors, and had a telegram from them, in which they would not admit any responsibility themselves, but offered to give the name of the party consigning it to them. The Chairman said that while bound to convict, the Bench did not believe there had been any fraudulent intention on the part of the defendant. In order to protect himself in future he must obtain a warranty with his butter when he purchased it. They would only inflict a nominal fine of 10d., which, with 16s. 8d. costs, would make 17s. 6d. for defendant to pay.

"First Cork Butter;" Conviction for Adulteration :—

At Wokingham, on November 3rd, James Jennings, grocer, of Denmark Street, was summoned by Detective-constable Sheppard, inspector under the Food and Drugs Act for the county of Berks, for selling to him, on Sept. 22, a certain article of food, to wit, butter, the same not being of the nature, substance, and quality demanded. Defendant pleaded not guilty, stating that he sold the butter just as he received it. The inspector produced the analysis of the butter received from the County Analyst, showing that it contained 20 per cent. of water, 4½ per cent. of curd, and 6 per cent. of salt. Mr. J. Holmes (Holmes & Co., Reading) said his firm supplied the utter to the defendant. He contended that the analysis did not prove that it was adulterated; in fact, they purchased it as a "first Cork butter," and consigned it straight to their customers. The Bench imposed a fine of 2s. 6d. and 12s. 10d. costs, and Mr. Holmes advised the defendant to appeal against the decision, remarking that his firm would bear the expense. The defendant was further charged with selling adulterated coffee. The inspector bought some coffee, and the defendant handed him the article, a fourth part of which, on analysis, was found to be chicory. For this offence he was fined 2s. 6d. and 9s. 6d. costs.

In connection with the recent letter published in *The Times*, and reprinted on another page, the following case will be of interest:—

Conviction for Selling Watered Lard :—

Mr. John Dodd, grocer, 288, Ordsal-lane, was summoned to the Salford Police Court last week, for selling three-quarters of a pound of lard which contained 17 per cent. of water. Mr. J. C. Walker, assistant town clerk, appeared in support of the summons, and Mr. Edge, barrister, for the defendant. On the 4th inst. Mr. Charles Edward Thompson, inspector for the borough under the Sale of Food Act, visited the defendant's shop, and purchased three-quarters of a pound of lard at 7d. per pound. He paid 5d. for it and told the manager that he had purchased it for analysis. The manager said they did

not sell what the witness had purchased as pure lard. In cross-examination, Inspector Thompson said the defendant told him he sold the lard as "watered lard." Mr. J. C. Bell, public analyst, gave evidence to the effect that he had analysed the sample of lard sold by the defendant to the inspector and found it contained 17 per cent. of water. Pure lard was composed of pure pig's fat. For the defence, Mr. Edge contended that the prosecution had failed to prove that the water had been put into the lard for the purpose of increasing its bulk and to defraud the purchaser. The defendant sold the lard just as he got it from the wholesale dealer. There were three qualities of lard—the pure lard, the seconds quality, and the thirds quality. Now, if shopkeepers were compelled to sell only pure lard they would have to revolutionise their business, and if pure lard was only to be sold, the public would have to pay for it. In this case there was no fraud; the sample sold to the inspector was thirds quality, and he only paid thirds price for it. If shopkeepers were to be harassed by prosecutions of this sort, it would be almost impossible for them to carry on their business. Mr. Makinson said there must be a conviction, because he believed the water had been added for the purpose of increasing the bulk of the lard, but taking into consideration the fact that defendant sold the lard as he got it, the defendant would only be fined 20s. and costs. Mr. Edge applied for a case for a higher court if necessary, and the application was granted.

Mr. J. Falconer King, Analyst to the City of Edinburgh, has been appointed Public Analyst for the County of Selkirk.

RECENT CHEMICAL PATENTS.

The following specifications have been recently published, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

No. 1881	Name of Patentee.	Title of Patent.	Price.
774	J. Fife	Electric Lamps	2d.
814	J. M. Bonneville	Treating Nitrous or Nitrous Ether Derivatives of Sugar	2d.
964, 965, 966	W. Weldon	Manufacture of Chlorine .. each	4d.
967	Do.	Manufacture of Hydrochloric Acid and Chlorine	4d.
1232	H. E. Upton	Electric Lamps	2d.
1236	J. A. Berly	do.	8d.
1261	H. E. Newton	Manufacture of Sulphocyanides and Ferrocyanides	10d.
1289	P. Jensen	Manufacture of Soap from Animal and Vegetable Fatty Matters	4d.
1291	B. J. Mills	Treating Hominy	4d.
1424	W. G.	Manufacture of Acetate of Soda	4d.
1470	A. M. Clark	Manufacture of Sugar	4d.
1487	E. G. Thomas	Manufacture of Colouring Matters	4d.
1530	J. C. Smith	Manufacture of Cement	6d.
1536	J. L. Dupont-Auberville	Electric Lamps	6d.
1543	St. G. L. Fox	Electric Lamps	6d.
1562	H. H. Lake	Manufacture of Soap	4d.
1547	E. G. Brewer	Manufacture and Refining of Artificial Butter	8d.
1555	J. G. Tongue	Treating Bituminous Substances	6d.
1564	R. Wild	Treating and Purifying Sewage	6d.
1570	R. Pease and T. Lupton	Treating House Refuse and Sewage Matter for Manure	8d.
1587	W. Young	Manufacture of Mineral Oil and Ammonia	1s.
1596	A. W. Reddie	Electric Lamps	6d.
1605	A. M. Clark	Extracting Oxides of Zinc and Copper from Ores	4d.
1670	G. S. Grimston	Electric Lamps	6d.

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; Journal of Applied Science; The Provisioner; The Practitioner; New Remedies; Proceedings of the American Chemical Society; Le Practicien; The Inventors' Record; New York Public Health; The Scientific American; Society of Arts Journal; Sanitary Engineer of New York; The Chemists' Journal; Oil and Drug News; The Textile Record of America; Sugar Cane; Country Brewers' Gazette; The Medical Record; Oil and *Drug* Journal; The Canada Lancet.

The Analyst,

INCLUDING THE PROCEEDINGS OF

THE "SOCIETY OF PUBLIC ANALYSTS."

A MONTHLY JOURNAL FOR THE INFORMATION OF THOSE INTERESTED IN THE PURITY OF FOOD AND DRUGS, AND IN GENERAL ANALYTICAL AND MICROSCOPICAL RESEARCH.

EDITED BY

G. W. WIGNER, F.I.C., F.C.S., LONDON AND AMERICA,

ONE OF THE

Hon. Secretaries of the Society of Public Analysts;

AND

J. MUTER, Ph.D., F.I.C., F.C.S.,

Vice-President of the Society of Public Analysts.

VOL. VII.

1882.

LONDON:

PUBLISHED FOR THE PROPRIETORS, BY MESSRS. BAILLIÈRE, TINDALL & COX,

KING WILLIAM STREET, STRAND, W.C.

-1900?-

LONDON:
PRINTED BY JOHN DAVIS,
201, OLD KENT ROAD, S.E.

INDEX.

A

B

THE ANALYST.

JANUARY, 1882.

SOCIETY OF PUBLIC ANALYSTS.

A Special General Meeting was held on the 14th December last at Burlington House; the President, Mr. Heisch, in the chair.

The minutes of the previous meeting were read and confirmed.

The ballot papers having been opened, it was reported that the following gentlemen had been duly elected:—as a Member, Mr. C. N. Hake, F.I.C., Analytical Chemist, London; as Associates, Mr. J. P. Laws, Assistant to Mr. Bernard Dyer, and Mr. F. T. Strutt, Assistant to Dr. Hodgson Ellis, of Toronto. Mr. Hugh McCallum, Government Analyst, Hong Kong, was proposed as a member.

The following paper was read and discussed:—"Some Observations on the Permanganate Test," by A. Dupré, Ph.D., F.R.S., &c.

The paper, "On a New Method of Testing for Alum," announced to be read by Mr. Wyntor Blyth, was postponed, owing to the author's unavoidable absence.

The Annual Meeting will be held at Burlington House on Wednesday, the 18th inst., at 5 o'clock, when the ballot for the Officers and Council for this year will take place and the usual address by the President will be given. The paper postponed from the last meeting, "On a New Method of Testing for Alum," by A. Wynter Blyth, M.R.C.S., &c., will be read, and the author will give some experimental illustrations; and a paper "On the Manufacture of Chloride of Sulphur," by J. Carter Bell, F.C.S., will also be read.

After the meeting, the Annual Dinner will be held, of which due notice will be sent to members.

SOME OBSERVATIONS ON THE PERMANGANATE TEST.

By A. Dupré, Ph.D., F.R.S., &c.

Communicated to the Society of Public Analysts on 14th December, 1881.

The Committee of the Society having put forward a certain method for estimating the amount of oxygen absorbed, it may perhaps be advisable to give some reasons for that method to show that it is really an advantage compared with the older one.

The first point for consideration is, Does permanganate suffer decomposition spontaneously at 80 degrees Fahr. in the presence of so much sulphuric acid? I have made a great many experiments, and find that, in really pure water, there is, practically, no decomposition at 80 degrees Fahr. after four hours; or at any rate the amount decomposed is always well within the limits of experimental error. It may, therefore, be taken as established that if the experiment is carried out in a closed vessel there is no spontaneous decomposition, and consequently all the oxygen that is found to be absorbed at that temperature must have been absorbed by some substance present in the water. In an open vessel this could not be assumed, as I do not think it would be possible to heat water in

an open vessel to 80 degrees with permanganate without some decomposition. The point is of importance, because it does away with the second, blank experiment so strongly recommended by Tidy. He makes two experiments; he adds the same amount of permanganate to the water being examined and to distilled water. He takes the distilled water as his standard, and at the end of three hours calculates from that the oxygen absorbed in the other. If the vessel is closed this is entirely unnecessary, and one great source of error, the possibility of traces of impurity present in the distilled water or absorbed from the air, is removed.

This closed vessel makes, however, another precaution necessary. I do not know whether all our analysts do so, but it is necessary to standardize the permanganate in a closed vessel, for if you standardize in a beaker less hyposulphite is required, unless you do the titration very rapidly. If you do it slowly you always get a lower result in the beaker than in the bottle. I should not be astonished if some of the results of no oxygen absorbed are really due to the loss occasioned in that way.

In some of my experiments the amount of oxygen absorbed, determined as rapidly as possible in a bottle, or in a beaker, was found to be 11·2 to 11·25 c.c. of hypo. Taking ten minutes for the titration, the hypo. comes down to 10·9, or sometimes even lower in the beaker, but remains the same in the bottle.

I must say I was rather astonished at that. I expected to find more iodine liberated by giving a little time, but instead of that there is less, and there is no doubt that a small amount of iodine volatilizes during the titration. If it is done in a bottle, and left even for half an hour, identical results are obtained. A result I did not expect. I expected a considerable increase in iodine liberation by the action of the sulphuric acid on the iodine.

The next point is with regard to the variation of the oxygen absorbed by the variation of temperature.

Here I found that if the water is very pure the amount of oxygen absorbed does not vary much with the temperature. The variation remains within the limits of experimental error, wherever it is done at 32 degrees or 80 degrees. If we take a somewhat less pure water there is, however, a very perceptible difference, and the more impure the water the greater is the difference in the amount of oxygen absorbed according to temperature. In the Trafalgar Square water the variation is only between ·017 and ·03. It seems proportionally large, but it is quite within the limits of error. It represents less than half a tenth of permanganate, which I may fairly take to be within experimental error. The same result comes out even if you increase the temperature up to 100 degrees.

Taking the water supplied to the Westminster Hospital, that absorbed ·0526 at 54 degrees, and ·065 at 80 degrees, which is of course a very measurable increase. If we take a still more impure water the difference becomes greater. A water I had from Farnborough gave 0·0395 at 32 degrees, 0·0554 at 60 degrees, and 0·0613 at 80 degrees, this being a very measurable increase.

It follows that if we have a water of great purity it really matters very little how we keep the temperature; but if our water is only of moderate purity, it is a matter of very great importance indeed to keep the temperature fairly uniform.

If the water is still more impure the difference increases, and 1 degree or 2 degrees Fahr. might then make a sensible difference.

It would be desirable to have some experiments made at lower temperatures, and I should not be surprised if a comparison between the action at a low and high temperature

would enable us to make distinctions between waters which the higher temperature alone does not enable us to do. We might distinguish between two kinds of organic matter, which, at a higher temperature, give the same result, but a different result at a lower temperature.

Variation in Time.—In a pure water the variation in time is not great—the oxidation comes to an end sooner than in an impure water; so that no great difference is found, whether the water is treated for three or four hours. Dr. Tidy told me that he never had a water that absorbed after three hours. That is so with pure waters, but not with impure ones, as in these there is a very decided increase from the three to four hours.

The Farnborough water, for example, in three hours absorbed ·055, and at four hours ·061 grains of oxygen, a very noticeable increase; and I have found the same in other waters. I have no doubt that with a really impure water four hours is not enough to give to the limit of what the permanganate process will do.

The next point to which I directed my attention is the variation of oxidation by varying the amount of permanganate; and here, also, the result corresponds very much with the preceding. With a fairly pure water it matters nothing whether you add 10 or 20 c.c. If you work well you come to the same result.

In the Trafalgar Square water, with 10 c.c. of permanganate I got 0·009, and with 20 c.c. 0·010, which is practically identical. Taking the Chelsea water, to which a little blood had been added, with 10 c.c. of permanganate, the oxygen absorbed was 0·115; but with 20 c.c. it had increased to 0·124.

I next tried phosphoric acid in place of sulphuric acid, bearing in mind that the latter decomposes the hydro-iodic acid, and renders the titration thereby somewhat inaccurate, and more particularly that it interferes with the sharpness of the final reaction.

Taking phosphoric acid (in equivalent proportions) the water remains generally more clear, and the final reaction is beautifully sharp. It has also a slight effect in making the oxygen absorbed, with varying amounts of permanganate, somewhat more uniform.

It diminishes, however, very appreciably the amount of oxygen absorbed. It has thus the advantage of rendering the end reaction sharper, and, perhaps, of making the amount of oxygen absorbed somewhat more independent of the amount of permanganate taken; but it diminishes the oxygen absorbed very considerably, and I have, therefore, returned to the use of sulphuric acid.

I next made a great many experiments with the permanganate test, with a view to throw some light on the organic matter present.

The first thing I did was to boil the water, and I found, to my great astonishment, that it increased the oxygen absorbed. That is to say, taking our Chelsea Company's water and estimating the oxygen absorbed direct, then boiling it for an hour, and again estimating the oxygen absorbed, an increase is observable.

As we always heat our water for some time with sulphuric acid, I thought I would try boiling the water with sulphuric acid. I found, on the whole, a noticeable increase in the amount of oxygen absorbed. Only occasionally did I find the reverse, and that was always when there was a considerable amount of nitrates present. With that exception I always found an increase, which seemed to be the greater the impurer the water, or perhaps the more recent the contamination. Or to put it broadly, if the organic matter is

already altered by natural action in the water, it does not get altered by boiling with sulphuric acid, a point which, if it should be confirmed by other observers, is of considerable importance.

I will now give you a few waters that have been purposely polluted. By far the most striking results were obtained by pure crystal sugar, a remarkably pure sample of which I obtained from Mr. Wigner. Adding sugar to the Trafalgar Square water increased the oxygen absorbed in four hours but slightly; but if the water is boiled with sulphuric acid it goes up to tenfold that amount.

Oxygen Absorbed in Four Hours at 80 deg. F.

By Trafalgar Square Water		0·010 grains.
" " " " + 1 grain of sugar		0·017 "
" " " " + 1 "	" boiled 1[h] with 10 c.c. acid	0·160 "
" " " " + 0·1 "	" ———————	0·009 "
" " " " + 0·1 "	" boiled 1[h] with 10 c.c. acid	0·016 "

This result led me to expect that the acid might be the means of distinguishing between vegetable and animal matters, but so far I have not been able to do so. I also tried alkali, and I had some hopes by its means of being able to distinguish between the two kinds of matter; but, though I took the utmost care to get the alkali pure, yet I found the purest soda, after acidifying with sulphuric acid, absorbed a considerable amount of permanganate. I suppose that the pure sulphate of soda has a sensible effect on permanganate. At any rate, however pure the water was, I never could get it to give no oxygen absorbed whenever I boiled with alkali; while boiling with sulphuric acid did not affect pure water.

Gelatine.—Taking 2·27 grains of gelatine per gall., I found that the water absorbed in four hours ·036 without boiling, and after boiling ·039—a very slight increase indeed. In half-an-hour it absorbed 017 without boiling, and ·036 after boiling. The effect is thus very slight in four hours, but very perceptible in half-an-hour.

Urine.—30 grains added per gall., and treated it in the same way.

Oxygen Absorbed per Gall. in—

	½-hour	1 hour.
By the Pure Water		0·010
" " " + Urine	0·056	0·064
" " " + " boiled with 10 c.c. acid	0·065	0·092

The difference is much larger than any experimental error would be.

Egg Albumen.—The amount I added was 1 grain to the 2 litre, which comes to 0·035 of dried albumen per gall. I have only the four-hour result, which is ·014 without boiling, 0·016 after boiling. The pure water, as before, absorbed 0·01.

The last substance tried was starch, which was rather disappointing. I expected to get a very noticeable increase. I added 2·27 grains per gall., and the oxygen absorbed without boiling was ·008 (in fact, exactly the same as the pure Trafalgar water), after boiling 0·020. The starch was taken, boiled up into a thin mucilage and then added to the water.

No doubt the proportional increase is considerable, yet the actual increase, compared to the quantity taken, is nothing like what one would expect. Evidently this boiling for an hour with 10 c.c. acid per ¼-litre does not convert the starch into sugar.

In reply to questions, Dr. Dupré said: I have made it a point to test all waters for nitrous acid with starch and iodide, but I use sometimes Gries' test, which is more

delicate. With these tests you may get the most intense colouration, and yet not the slightest discolouration of permanganate. All the experiments were made with soda made from sodium. I dissolved that to the corresponding strength of our sulphuric acid, and added permanganate and put it overnight in my warm chamber. I added permanganate till it was distinctly green, and yet when 10" of this soda solution were added to Trafalgar Square water, together with 20 c.c. sulphuric acid, there was always a noticeable decomposition of permanganate.

One of my reasons for bringing this subject forward in an incomplete form is that I may induce some of our younger members to devote some of their time to such experiments as these, my engagements not allowing me to carry the experiments further at the present time.

SOMERSET HOUSE ANALYSES.

By O. Hehner, F.C.S., F.I.C.

Read before the Society of Public Analysts on the 16th November, 1881.

On September 12th a sample of milk, taken on the same day by the Inspector of the Town Council of Derby, was submitted to and analysed by me with the following results:—

Specific Gravity	1027·4
Solids not fat	8·37 per cent. by weight.
Fat	3·49
Total solids	11·86
Ash	0·65

The duplicate analysis gave total solids 11·97, and ash 0·66 per cent.

On the ground of these figures—the specific gravity, solids not fat, and ash—all being low, I certified the milk to be adulterated with 10 per cent. of water.

The results of the analysis were indirectly corroborated by the inspector, who informed me afterwards that his attention had been directed to the fact that the person who sold the milk to the vendor had, on a previous day, been seen to add water to the milk, and that in consequence he purchased the sample.

The vendor asserting, as was doubtless correct, that not a drop of water had been added by her to the milk, the sample was sent to Somerset House, 26 days after my analysis was made.

Before giving their certificate, the Excise chemists requested the magistrate's clerk to give them information as to a number of points, "as the case presented some peculiarities." They specially wished to know whether the milk was the produce of a single cow or of a number of animals, and upon what kind of food they were fed, and were informed that the milk was from a well-fed herd of 30 cows, grass with a few grains forming the food.

On October 19th the following certificate was received:—

"The sample of milk referred to in the annexed letters, and marked No. 7, was received here on the 8th inst. The sample was securely sealed.

"We hereby certify that we have analysed the milk and declare the results of our analysis to be as follows:—

Solids not fat	7·89 per cent.
Fat	3·38 "
Water	88·43 "
	100·00
Ash	0·74 "

"After making the addition for natural loss arising from the decomposition of the milk through keeping, the amount of solids not fat is not lower than is found in genuine milk.

"The percentages of fat and ash are each equal to that found in genuine milk of good quality.

"From a consideration of these results, and of the particulars supplied, we are not prepared to affirm that water has been added to the milk.

"As witness our hands, this eighteenth day of October, 1881.

"(Signed) J. Bell.
G. Lewin."

It will be seen that the fat is slightly higher than in my analysis, whilst the total solids have diminished but little. Fermentative damages cannot have taken place to any great extent, doubtless owing to the cold weather prevailing during the period the sample was kept.

The certificate is remarkable in several respects. "After making *the* addition for natural loss." Does any chemist believe that there can be made a fixed addition for loss by decomposition? Fermentation is influenced by many circumstances, and it is not only impossible to make any real correction sufficiently accurate to corroborate or contradict the analysis made upon a sample when fresh, but it is much less possible to make a *fixed* addition or correction. Surely chemists who venture to speak of such corrections in such a manner must have considerable confidence in themselves or their powers.

"From the particulars supplied!" The particulars supplied, if they gave any help in coming to a conclusion at all, testified against the genuineness of the sample, and not in its favour.

The solids not fat being very low the percentages of fat and ash can have furnished the only guidance. Now, the amount of fat goes absolutely for nothing, milk much richer in fat having been found watered. Besides, it is well known that the fat rises as milk becomes old, nitrogenous matter furnishing fatty substances. The ash alone remains as safe measure of the quality of the milk.

Having made my analysis very carefully, and obtained results agreeing well, I felt confident that the amount of ash found by the Somerset House Chemists could not be correct. I did not allow the heat requisite for incineration to rise to redness, and notable loss by volatilisation was out of the question. I, however, repeated the ash determinations, and found in two very carefully performed experiments—Ash, 0·67 (1) and 0·67 (2). The fat had further risen to 3·89 per cent., the solids not fat fallen to 4·22, when the sample was analysed a few days ago (October 4th). The loss of substance by fermentation explains the very slight and insignificant rise in ash.

I am, therefore, in a position strongly to affirm the accuracy of my ash determination, four successive results agreeing as well as they can be expected to agree; and I do not hesitate to declare the only figure, upon which our Court of Appeal could scientifically have relied, to be erroneous and misleading.

Every indication in my analysis pointed in the same direction: the specific gravity, solids not fat, and the ash. On the other hand, we have only the ash, apparently contradicting any results. Public Analysts can form their own inferences from these facts.

Mr. J. Falconer King, F.C.S., Analyst to the City of Edinburgh, has been appointed Public Analyst to the Burgh of Galashiels.

ON TEA ASH.

By J. Carter Bell, F.C.S., &c.

The following fifty-eight samples of Tea were bought from grocers in the Borough of Salford and neighbourhood:—

Name of Tea.	Ash.	Ash soluble in water.	Ash insoluble in water.	Alkalinity of Ash calculated as Potash.
1 Congo	6·00	48·20	51·80	23·50
2 "	6·94	42·10	57·90	18·90
3 "	6·10	58·40	41·60	26·00
4 "	6·06	50·60	49·40	26·36
5 "	6·06	56·44	43·56	26·36
6 "	5·84	56·86	43·14	30·57
7 "	6·00	54·34	45·66	26·53
8 "	5·68	47·89	52·11	29·78
9 "	5·86	57·34	42·66	28·87
10 "	5·94	54·89	45·11	26·90
11 "	6·36	46·86	53·14	22·16
12 "	6·06	56·77	43·23	26·36
13 "	6·64	45·79	54·21	22·65
14 "	6·74	45·11	54·89	20·91
15 "	6·28	61·15	38·85	25·44
16 "	6·08	55·94	44·06	29·37
17 "	6·30	53·66	46·34	20·88
18 "	6·56	43·00	57·00	20·05
19 "	6·24	54·17	45·83	20·71
20 "	6·32	52·54	47·46	26·75
21 "	5·94	59·95	40·05	26·90
22 Green	6·48	58·58	42·42	21·76
23 "	7·00	43·72	56·28	16·00
24 "	6·14	61·25	38·75	27·55
25 "	6·64	45·43	54·57	27·06
26 "	8·46	37·36	62·64	15·43
27 "	6·36	57·24	42·76	28·39
28 "	7·50	47·47	52·53	23·81
29 "	6·16	48·06	51·94	25·94
30 "	6·36	57·55	42·45	26·60
31 "	6·32	67·41	32·59	28·25
32 "	5·82	58·08	41·92	25·84
33 "	6·14	50·49	49·51	26·02
34 "	7·06	54·68	45·32	21·30
35 "	6·00	61·34	38·66	26·63
36 "	6·08	56·58	43·42	27·79
37 "	7·24	45·03	54·97	20·77
38 Mixed	5·82	54·99	45·01	25·83
39 "	6·24	48·08	51·92	27·11
40 "	6·00	59·00	41·00	28·20
41 Caper	5·64	57·38	42·62	26·87
42 "	7·74	36·00	64·00	14·50
43 "	8·58	32·70	67·30	14·24
44 "	6·14	58·70	41·30	24·49
45 "	7·50	37·87	62·13	18·18
46 "	7·32	43·45	56·55	17·99
47 "	7·02	40·46	59·54	20·03
48 "	6·32	50·00	50·00	25·28
49 "	7·00	43·15	56·85	25·51
50 "	5·80	56·56	43·44	25·93
51 "	6·82	41·94	58·06	20·69
52 "	6·54	44·35	55·65	20·12
53 "	7·40	38·38	61·62	22·83
54 "	7·70	41·56	58·44	17·09
55 "	6·38	53·30	46·70	23·95
56 "	5·74	49·13	50·87	24·56
57 "	6·86	43·45	56·55	21·92
58 Tea Dust	6·10	49·19	50·81	27·70

The Note on "The Adulteration of Balsam of Peru," by Dr. Senier, in our November number, was printed by mistake without acknowlegment. It was really an abstract contributed by Dr. Senier to, and copied by us from the *Sanitary Engineer*, of New York.

SOCIETY OF PUBLIC ANALYSTS.

Analyses of English Public Water Supplies in December, 1881. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Date when drawn.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine in Chlorides.	Phosphoric Acid in Phosphates.	Nitrogen in Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in		Hardness, Clark's Scale, in degrees.		Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
									15 mins. at 80° Fahr.	4 hours at 80° Fahr.	Before Boiling.	After Boiling.			
Kent Co.	Dec. 16	c. p. blue	none	1·98	trace	·490	·0074	·0030	·0080	·0120	20·8°	5·5°	29·00	vegetable debris	Wigner & Harland.
New River	" 15	c. s. yellow	none	1·12	trace	·269	·0028	·0028	·0400	·0800	16·0°	3·5°	22·68		B. Dyer.
East London ..	" 8	c. yellow green	none	1·14	trace	·203	·0014	·0078	·0160	·0480	15·0°	4·0°	22·80	vegetable debris	Wigner & Harland.
Southwark & Vauxhall ..	" 15	yellow and clear	none	1·24	trace	·170	·0010	·0070	·0600	·1088	14·5°	4·0°	19·90	satisfactory	J. Muter.
West Middlesex	" 19	yellow	none	1·06	trace	·181	·0012	·0060	·0672	·1096	13·7°	3·8°	21·80		O. Hehner.
Grand Junction	"	p. yellow	none	1·24	trace	·151	·0008	·0076	·0334	·0926	14·7°	4·6°	21·20		A. Wynter-Blyth.
Lambeth	" 15	yellow and clear	none	1·24	trace	·150	·0010	·0080	·0644	·1064	14·5°	4·0°	19·70	satisfactory	J. Muter.
Chelsea	" 14	c. grnsh. yell.	none	1·26	trace	·170	·0010	·0115	·0590	·0980	17·0°	4·5°	22·26		A. Dupré.
Birmingham ..	Dec. 6	clear blue	none	1·12	none	·154	·0007		·0013	·0044	12·2°	6·0°	22·90		A. Hill.
Bolton........	" 6	s. turbid yellow	none	·48	none	·038	·0015	·0063	·0188	·0370	3·2°	3·0°	6·42	mineral mtr. veg. debris	W. H. Watson.
Bradford	" 15	v. s. op., s. pt. yl.	none	·70	none	none	none	·0049	·0260	·1560	4·5°	4·3°	8·30	none	F. M. Rimmington.
Brighton......	" 11	c. blsh. green	none	2·05	none	·392	·0084	·0041	·0040	·0040	12·6°	3·6°	21·20	vegetable debris	Wigner & Harland.
Bristol........	Nov. 28	brownish green	none	·90	none	·044	none	·0042	·0179	·0358	16·8°	1·6°	19·20	sand, diatoms	F. W. Stoddart.
Bury (Lan.) ..	Dec. 6	s. turb yellow	none	·88	trace	·046	·0050	·0072	·0170	·0370	4·5°	4·4°	7·55	min. mtr. veg. deb.	W. H. Watson.
Cambridge	" 14	p. ble. v. s. turb.	none	1·30	trace	·560	·0014	·0028	·0056	·0084	16·0°	5·0°	26·00	satisfactory	J. West Knights.
Canterbury	" 21	c. pale blue	none	1·47	none	·411	·0005	·0006	·0020	·0060	5·0°	3·4°	9·80	s. mineral	S. Harvey.
Croydon	" 20	f. grnsh. blue	f. earthy	1·05	trace	·179	·0060	·0010	·0084	·0084	15·5°	6·5°	24·00	none	C. Heisch.
Darlington	" 19	s. yellow	none	1·05	trace	·032	trace	·0035	·0541	·1174	9·5°	4·5°	11·20	min. matter veg. debris	W. F. K. Stock.
Dublin	Nov. 28	s. yellow	none	·99	trace	traces	·0020	·0060	·0050	·0300	1·3°	·6°	4·35	satisfactory	C. A. Cameron.
Edinburgh	Dec. 13	s. brown	none	·80	none	trace	trace	·0024	·0160	·0400	4·9°	4·7°	8·32	none	J. Falconer King.
Exeter........	" 3	f. brnsh. yellow	none	·84	trace	·109	·0007	·0038		·0721	2·9°	2·9°	7·00	earthy and veg. debris	F. P. Perkins.
Grantham	" 17	s. blue s. turb	none	1·12	trace	·780	·0009	·0015	·0045	·0155	14·8°	5·0°	23·18	diat. confer. & mov. orgs.	A. Ashby.
Greenock	" 8	c. brnsh. yellow	none	·80	none	·001	·0009	·0115	·1700	·2000	1·8°	1·6°	5·52		J. W. Biggart.
Hastings	" 12	grnsh. s. cloudy	none	4·90	trace	·105	·0035	·0052	·0020	·0050	9·5°	6·0°	28·40	vegetable debris	H. H. Cheshire
Ipswich	" 16	colourless	none	2·24	trace	·420	·0030	·0038	none	·0054	23·5°	4·5°	33·45	satisfactory	J. Napier.
King's Lynn ..	" 10	drty. grsh. yell.	v. faint	1·69	trace	·142	·0028	·0056	·0200	·3587	18·0°	6·5°	28·70	moving organisms	W. Johnstone.
Leamington ..	" 1	greenish	none	1·54	none	none	·0028	·0021	none	·0045	26·1°	13·6°	30·10	none	A. Bostock Hill.

SOCIETY OF PUBLIC ANALYSTS.

Analyses of English Public Water Supplies in December, 1881. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Date when drawn.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine in Chlorides.	Phosphoric Acid in Phosphates.	Nitrogen in Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in		Hardness, Clark's Scale, in degrees.		Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
									15 mins. at 80° Fahr.	4 hours at 80° Fahr.	Before Boiling.	After Boiling.			
Leicester......	Dec. 19	s. yellow	none	1·73	trace	·096	·0017	·0039	·0225	·0840	8·4°	5·0°	14·60	vegetable debris	W. L. Emmerson.
Liverpool	,, 9	grnsh. yellow	s. peaty	1·08	trace	·062	·0007	·0021	·0392	·1055	5·2°	4·2°	9·52	s. vegetable debris	A. Smetham.
Maidstone—															
*Wtr. Company	Nov. 28	brn. v. muddy		2·20	h. trace	·470	·0060	·0231	·1495	·2996	10·4°	6·3°	33·20	veg. debris earthy matter	M. A. Adams.
Wtr. Company	Dec. 12	grsnh. brn. opq.		2·90	trace	·570	·0014	·0049	·0501	·0548	19·7°	9·1°	43·80	mineral matter	M. A. Adams.
Public Conduit	,, 9	grn. blue		2·10	trace	·380	none	·0028	·0031	·0039	19·5°	7·7°	36·70	none	M. A. Adams.
Manchester....	,, 21	v. s. turb. f. yell.	none	·62	none	none	·0038	·0055	·0111	·1112	2·1°	2·0°	4·91	s. mineral	W. Thomson.
Newark	,, 17	c. grnsh. blue	none	1·30	trace	·052	·0024	·0043	·0154	·0406	17·2°	14·0°	37·15	diatoms	A. Ashby.
Newcastle-on-Tyne......	,, 8	f. yellow	none	·85	trace	·036	·0010	·0080	·0570	·1020	16·0°	5·7°	21·00	satisfactory	J. Pattinson.
Norwich	,, 10	p. grnsh. yellow	none	2·00	trace	·058	traces	·0044	·0340	·0620	15·0°	4·0°	20·00	satisfactory	W. G. Crook.
Nottingham ..	,, 14	c. grnsh. blue	decided	1·91	none	1·400	·0012	·0066	·0040	·0040	11·5°	5·5°	27·80	mycelium, veg. debris	Wigner & Harland
Portsmouth ..	,, 12	v. s. turbid	none	1·12	trace	·240	trace	·0021	none	none	17·0°	2·0°	18·20	vegetable debris	W. J. Sykes.
Reading	,, 1	f. grnsh. yellow	none	1·10	trace	·145	·0014	·0081	·020	·056	15·1°	4·0°	19·85	amorphous	J. Shea.
Rochdale	,, 18	pale blue	none	·68	none	·010	·0030	·0028	·0002	·0070	2·8°	2·5°	3·80	satisfactory	T. A. Collinge.
Rugby	,, 13	f. turbid		1·26	h. trace	·130	·006	·0196	·0280	·0532	11·0°	8·5°	16·80	wms.,hrs.,vg.db.,snd.,&c.	A. P. Smith.
Salford	,, 1	v. cloudy yellow	none	·70	none		·0028	·0070	·0440	·1340	3·0°	2·5°	10·00	oxide of iron	J. Carter Bell.
Shrewsbury ..	,, 10	c. colourless	none	1·45	trace	·260	none	·0040	·0080	·0080	21·5°	7·5°	24·60	none	T. P. Blunt.
Southampton ..	,, 21	c. p. yellow	none	1·26	h. trace	·493	·0030	·0056			15·0°	5·0°	23·00	vegetable debris	A. Angell.
Swansea	,, 16	s. turbid	none	·90	trace	none	·0010	·0063	·0030	·0040	1·6°	1·6°	4·40	none	W. Morgan.
Whitehaven ..	,, 8	c. f. green	none	·39	none	·004	none	·0008	·0083	·0173	·4°	·4°	1·90	satisfactory	A. Kitchin.
Wolverhampton	,, 15	brownish	none	1·33	trace	·126	·0007	·0063	·0224	·0560	13·1°	6·7°	22·40	earthy and few diatoms	E. W. T. Jones.

Abbreviations:—c., clear; f., faint; h., heavy; p., pale; v. h., very heavy; v. s., very slight.

* When River was flooded.

THE PUBLIC WATER SUPPLIES OF ENGLAND.

VALUATION, ACCORDING TO "WIGNER'S VALUATION SCALE," OF THE ANALYSES PUBLIS THIS MONTH.

In the following table we give the *average* valuation of those public water supp reported on this month from January to June, and the valuation of the July, Aug September, October, November, and December waters.

	Average to June.	July.	August.	Sept.	October.	Nov.	Dec
LONDON— Kent	30	27	20	27	29	26	29
New River	26	17	17	21	24	25	34
East London	32	39	20	28	35	46	37
Southwark and Vauxhall	34	28	31	27	30	43	53
West Middlesex	30	24	29	39	33	43	50
Grand Junction	30	23	25	30	31	36	39
Lambeth	37	29	31	26	33	37	50
Chelsea	30	26	32	36	37	43	51
Bath	12	19	20	..	13	16	..
Birmingham	33	37	26	29	36	47	29
Bolton	..	17	19	17	28	29	26
Bradford	53	53	59	44	36	31	39
Brighton	24	23	25	21	22	25	28
Bristol	22	27	..	30	29	24	23
Bury	..	35	24	24	30	33	31
Cambridge	28	26	22	21	22	22	25
Canterbury	17	22	16	12	15	13	14
Croydon	27	30	..	..	22	21	21
Darlington	33	39	96	50	74	62	46
Derby	18	13	..	..	..	..	..
Dublin	23	..	13	..	..	..	15
Edinburgh	28	21	20	24	31	28	19
Exeter	20	16	23	23	18	23	22
Grantham	27	..	32	..	70	30	30
Hastings	..	20	25	..	27	25	34
Huddersfield	23	26	28	..	..	..	..
Ipswich	27	30	30	..	28	25	28

	Average to June.	July.	August.	Sept.	October.	Nov.	Dec.
King's Lynn	94	110	48	110	84	128	111
Leamington	26	..	26	..	24	..	24
Leeds	35	28	22	..	..	..	..
Leicester	42	24	26	23	25	27	31
Liverpool	36	29	41	47	37	31	36
Maidstone— Water Company	39	34	30	31	38	35	55
,, Public Conduit	36	28	25	27	31	27	26
Manchester	22	17	29	28	49	27	27
Newark	39	46	41	..	33	34	37
Newcastle-on-Tyne	37	40	43	68	57	55	39
Norwich	36	49	36	33	34	38	34
Nottingham	39	46	38	42	62	55	58
Plymouth	29	..	..	28	..	..	..
Portsmouth	30	22	26	27	24	29	25
Reading	25	20	34	23	25	18	38
Rochdale	9	7	9	..	5	12	7
Rugby	41	..	..	46	69	55	48
Salford	18	14	21	21	15	14	44
Sevenoaks	20	..	..	..	..	20	..
Shrewsbury	23	..	17	19	21	25	25
Southampton	43	..	40	40	40	37	45
Sunderland	25	27	..	..	..	..	..
Swansea	16	14	19	15	12	12	15
Tunbridge Wells	..	..	..	35	..	..	..
Warwick	34	34	..	40	..	40	..
Whitehaven	9	17	14	10	10	7	7
Wolverhampton	46	39	32	15	33	41	38

Owing to considerations of space we have omitted from this table those places a which we have published no analyses during the past five months.

In the case of the Metropolitan waters, the average valuation of the supplies December show an increase of nearly 6 over the valuation for November, but the increas mainly in the supplies of the companies drawing from the rivers Thames and Lea. T *Kent water* shows an increase of 3 in value, the New River water an incre

in the valuation of only one, while the other companies have increases ranging from 3 in Grand Junction to 1 in Lambeth.

Among the provincial supplies reported on this month the most pure are Rochdale and Whitehaven with a valuation of 7 each, Canterbury 14, Dublin and Swansea 15 each, and Edinburgh 19. In these there is scarcely any notable change from last month, with the exception of Edinburgh which shows a marked improvement.

Following these best waters we have Croydon with a valuation of 21, Exeter 22, Bristol 23, Leamington 24, Cambridge, Portsmouth, and Shrewsbury 25 each, Bolton and Maidstone Public Conduit 26 each, Manchester 27, Brighton and Ipswich 28 each, Birmingham 29, and Grantham 30. In these figures the only change of note is the remarkable improvement in the Birmingham supply.

The valuations of Bury, Darlington, King's Lynn, Newcastle, Norwich, Rugby, and Wolverhampton show an improvement over the valuations of last month, while, on the other hand, the waters of Bradford, Hastings, Leicester, Liverpool, Maidstone Company, Newark, Nottingham, Reading, Salford, and Southampton give less satisfactory indications, the Maidstone and Salford waters showing much higher valuations than previously owing to the turbidity of the samples.

ANALYSTS' REPORTS.

Dr. Cameron, Public Analyst for Dublin, in his report for November last, states that he examined during the month 34 samples, comprising 28 milks, five of which were adulterated with from 12 to 100 per cent. of added water, one coffee, one mustard, and four pepper.

Dr. J. F. Hodges, Analyst for Belfast, in his last quarterly return, states that he has submitted to analysis 41 articles of food and drink, viz:—nine samples of buttermilk, 18 of sweetmilk, one of coffee and chicory, one of spirits, eight of black pepper, and four of mustard. Of these seven samples of buttermilk were found adulterated by large additions of water; two samples of sweetmilk were diluted with water. The mixture of coffee and chicory contained only about ten per cent. of coffee. The spirits had been diluted below the legal strength; and seven of the samples of pepper were rendered impure by the presence of earthy matters.

LAW REPORT.

Magistrate not to decide as to the fact of Adulteration.—Decision on Appeal:—

With reference to the important case briefly noticed at page 155 of our last vol., in which a magistrate had decided that it was for him and not for the analyst to decide as to the fact of adulteration, it may be of interest to our readers if we give the judgments of Justices Lindley and Mathew reversing the magistrate's decision, for which we are indebted to Mr. Farnfield.

Shortly stated the case was this—Henry Richards had been summoned by W. T. Harrison, an Inspector for the Poplar Board of Works, for selling adulterated milk. The certificate of the analyst, Mr. W. C. Young, gave the usual figures, and stated, "I am of opinion the same is a sample of milk adulterated with 20 per cent. of water." The magistrate (Mr. Lushington) considered that he and not the Public Analyst was the ultimate judge of the matter in issue, whether the defendant had sold to the inspector milk adulterated with water. He took it to be matter of notoriety and common observance that the milk of different cows, and of the same cows under different circumstances, varied considerably in richness and in the proportion of its several constituents; he compared the results certified by Mr. Young with some obtained by Dr. Voelcker, and came to the conclusion that it was fully possible that the defendant's milk was in fact a sample of very poor but genuine milk, from which some of its original richness had been abstracted in the process of gradually ladling out for sale, without any fraudulent adulteration with water, and the magistrate declined to convict the defendant. He was of opinion that he had satisfied the statute (Sale of Food Act, ss. 21, 22) by receiving the analyst's certificate as sufficient evidence of the constituents of the milk, and that he was left free by the statute to question and examine for himself the correctness of the certificate, so far as regarded the analyst's conclusion that the milk had been adulterated.

The magistrate gave a special case, which was argued by counsel for the Poplar Board of Works, before the Queen's Bench Division, and the following are the judgments delivered:—

Mr. Justice Lindley: Nobody appearing on the other side I think we have seen enough to say that the magistrate has put too narrow a construction upon s. 21, which runs thus, "At the hearing of the information in such proceeding the production of the certificate of the analyst shall be sufficient evidence of the facts therein stated, unless the defendant shall require that the analyst shall be called as a witness, and the part of the article retained by the person who purchased the article shall be produced, and the defendant may, if he thinks fit, tender himself and his wife to be examined on his behalf." The form of the certificate throws some light upon the proper construction of the expression "evidence of the facts therein stated." The facts to be stated in the certificate are to be the result of an analysis, and the form is, "I have analysed the same and declare the result of my analysis to be as follows":—that is one set of facts; then comes an expression which is another fact, and it runs thus: "I am of opinion that

the said sample contained the parts as under, or the percentages of foreign ingredients as under." What the analyst here has done is this—he has analyzed this milk, and he sets out the result of the analysis in the certificate, and then he gives in the note his opinion, and his opinion is that the sample of milk is adulterated with 20 per cent. of water. That is *prima facie* evidence; of course, it is not conclusive, but it is *prima facie* evidence, which, in this case, the person charged did not attempt to dispute. It is to be taken for what it is worth, and the Act of Parliament presumes what it is worth. It says that it is to be *prima facie* evidence. Therefore, I think it was not right on the part of the magistrate here to take the course he did, because what he did was to disregard the only evidence there was in the case. There was no other evidence at all, but he has not given effect to it.

Mr. Justice Mathew: I am entirely of the same opinion.

Mr. R. Brown: Then the case is remitted to the magistrate for conviction?

Mr. Justice Lindley: Not for conviction. The case is remitted back, then that will give the magistrate an opportunity of explaining it. I think the question is whether he was right. We will answer the question by saying that in our opinion his determination was erroneous in point of law, and then the case is remitted to him for his determination.

RECENT CHEMICAL PATENTS.

The following specifications have been recently published, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

No. 1881	Name of Patentee.	Title of Patent.	Price.
1639	J. Deucker	Production of Nitro Benzole	2d.
1653	J. H. Johnson	Electric Lamps	8d.
1658	H. E. Newton	Manufacturing Sugar	6d.
1685	A. M. Clark	Electric Lamps or Regulators	8d.
1704	G. Atkinson	Refining Camphor	6d.
1720	A. M. Clark	Treating Dolomite and Magnesian Limestones	4d.
1721	Ditto	Manufacture of Carbonates of Soda and Potash	2d.
1731	A. A. Ceoll	Manufacture of Sulphate of Alumina	4d.
1767	F. A. Zimmermann	Manufacture of Dyes	6d.
1768	Ditto	Production of Magnesia and Sulphate of Calcium	2d.
1786	F. Wirth	Production of Solid Fat Acids from Oils or Oleic Acid	4d.
1802	P. Jensen	Electric Lights	10d.
1820	S. Pitt	Preparation of Magnesia for separation of Ammonia from Excrementitious Matter	4d.
1844	H. E. Newton	Apparatus for Filtering Chemical Solutions and Drying the Precipitates	6d.
1893	C. D. Abel	Rendering available for Manufactures Sulphuric and Sulphurous Acid contained in Furnace Gases	4d.
1896	S. Cliff	Separating the Lime and Magnesia in Dolomite	2d.
1909	H. Wedekind	Production of Magnesia	2d.
1922	J. B. Rogers	Electric Lamp	6d.
1942	J. Brockie	Electric Arc Lamps	6d.
1943	E. G. Brewer	Electric Lighting	4d.
1957	W. Weldon	Manufacture of Sulphuric Acid	4d.
1974	H. N. Lay and H. Bulford	Condensing Fumes from Roasting Arsenical and Sulphurous Pyrites	6d.
2004	H. Collet	Treatment of Sewage for producing solid matter therefrom	6d.
2017	E. Solvay	Manufacture of Soda	2d.
2113	Ditto	Ditto	4d.
2019	W. R. Lake	Manufacture of Sugar	2d.
2035	W. P. Thompson	Treating Iridium	4d.
2079	C. H. Gimingham	Electric Lamps	2d.
2080	A. M. Clark	Apparatus for Making Oxygen and Hydrogen	1s. 2d.
2091	J. Keith	Manufacture of Gas	6d.
2136	J. A. Dixon	Manufacture of Artificial Alizarine	4d.
2198	C. D. Abel	Electric Lamps	6d.
2213	E. S. Samuel	Production of Hydrogen Gas and Manufacture of Ammonia	2d.
2314	G. M. Allender	Preservation of Butter	2d.

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; Journal of Applied Science; The Provisioner; The Practitioner; New Remedies; Proceedings of the American Chemical Society; Le Practicien; The Inventors' Record; New York Public Health; The Scientific American; Society of Arts Journal; Sanitary Engineer of New York; The Chemists' Journal; Oil and Drug News; Sugar Cane; Country Brewers' Gazette; The Medical Record; Oil and Drug Journal; The Canada *Lancet*; A Manual of Sugar Analysis, by J. H. Tucker, Ph.D., D. Van Nostrand, New York.

THE ANALYST.

FEBRUARY, 1882.

SOCIETY OF PUBLIC ANALYSTS.

THE ANNUAL MEETING of this Society was held on the 18th January, the President, Mr. Heisch, in the chair.

The minutes of the previous meeting were read and confirmed.

The President delivered his Annual Address as follows :—

GENTLEMEN,—It is now my duty in conformity with annual custom to make a few remarks to you in resigning into your hands the office of President, to which you did me the honour of calling me last year.

Firstly, as regards the state of our Society, I am glad to be able to congratulate you on our growing prosperity, both numerical and financial.

During the past year we have lost but one member by death, and, though the circumstances attending his decease are more than usually painful, still, considering our numbers, it is a matter of congratulation that it is the only death we have to record.

Four members have been removed from the roll of the Society for non-payment of fees, making a total of five lost to the Society.

On the other side 22 new members, if we include the one ballotted for to-night, have been added, our total number of Members being 116, and of Associates, 18—134 in all.

Our balance at the bank is £22 14s. 3d., being £6 7s. 8d. more than this day last year, though the expenses for printing, stationery, &c., have (owing to the carrying out of the scheme for water analyses) been exceptionally heavy, and two more meetings have been held than in any previous year, viz., eight in London and one in the country.

Much good work has been done by members of the society, as is evidenced by the fact that, at the meetings referred to 25 papers have been read, while six—which want of time prevented our reading, have been published in THE ANALYST.

We have also this year in our capacity as a Society laid before the public what I think may be called the first set of strictly comparable analyses of the public water supplies of the country. This has only been effected by all the members who took part in the analyses to some extent sinking their individual opinions and working loyally on the lines laid down by the majority to secure that which all must consider of the utmost importance—uniformity of results. The first and second editions of the instructions for these water analyses were quickly exhausted, and an enlarged edition has, after revision by the Water Committee, been published in THE ANALYST.

In addition to the monthly tables of the analyses of the Public Water Supplies, a description of all the sources of supply has also been published, all which has entailed on

our secretaries an amount of extra work which few would have been found to undertake. We are also indebted to one of the secretaries, Mr. Wigner, for the admirable digest of the work done by Public Analysts in 1880, which is a very valuable piece of statistics.

Before concluding, I should like to say a few words on the relations of Public Analysts to another body—which some have called the Court of Appeal, as I think there is a wide-spread misunderstanding, not only in the minds of Public Analysts but in those of vestry clerks and magistrates, on this subject. Most magistrates act as if the certificates of the Somerset House officials were not only evidence, but final evidence. Now those of us who followed the stages of the Sale of Food and Drugs Act, will all remember that when Sir H. Peek proposed to insert after Somerset House the words, "whose decision shall be final," Mr. Sclater-Booth, who had charge of the bill, refused to insert them, and when the matter was pressed to a division they were rejected by a large majority. Not only this, but Mr. Booth declared in his place in Parliament, that he did not intend the Somerset House decision to be final, but that the analysts should both be subject to examination on oath in case they differed, and should each have the opportunity of justifying their decisions if they could. It has been regretted that red tape has prevented our knowing the limits, &c., adopted by the Somerset House chemists. If Public Analysts whose certificates have been called in question had been properly represented by the legal officers of their boards, and the Somerset House chemists had been put into the box and examined on oath, no number of yards of red tape would have prevented our knowing by this time both their limits and their processes. Mr. Hehner brought a case before you recently, in which, by taking it for granted that some certain specific loss occurred in milk solids by keeping, the Somerset House chemists reversed his decision. As far as appears on the face of his case, they did not doubt his conclusions, but his analysis. Now I take it that, if these gentlemen had been asked on oath "Are you prepared on the faith of an analysis made when the milk is sour to say that the analysis made when it is fresh is wrong?" it would have required more ignorance than I give the Somerset House chemists credit for to answer, Yes. All Public Analysts are obliged by the form of their certificates to state if any change has taken place in a sample to interfere with the analysis. Why are the Somerset House chemists to be free from this obligation? and why are they alone permitted to make "the addition for natural loss arising from the decomposition of the milk through keeping." If a Public Analyst gave such a certificate we know pretty well what would be the result.

Another case, which is reported in the *Daily Telegraph* of Dec. 3rd, brings out a different point. The Analyst certified that a sample of milk contained 12 per cent. of added water. On appeal, the Somerset House chemists certified "that the solids not fat were not lower than they had found in pure milk of low quality, and they therefore could not say that water had been added." Unfortunately, no figures are given in the report. Mr. Paget, before whom the case was tried, and who has before expressed the opinion that "it is all guess work," dismissed the summons with costs, and we have the affair put in the paper with the heading "Conflicting Analyses." Had the Somerset House chemist been examined we should have known the meaning (if any) of "pure milk of low quality," and whether the gentleman in question saw the cows, from which it was derived, milked, or knew anything of their condition or feeding? Gentlemen, I have thought it right to make

these remarks, because I think it time that we, as a Society, should take means to call the attention of Public Analysts, vestry clerks, and even magistrates, to the fact that Somerset House certificates, even if evidence at all, are not final, and that we have a right to call the givers of these certificates to justify them on oath. In conclusion, let me thank you all for the kindness with which during my year of office you have one and all treated me, and the forbearance you have shown to my numerous shortcomings.

The ballot for the Officers and Council for the current year was then taken.

Mr. Angell and Mr. Hobbs were appointed Scrutineers to examine the ballot papers, and reported that the following had been elected:—

President.

C. Heisch, F.C.S., F.I.C.

Vice-Presidents.

J. Muter, Ph.D., M.A., F.C.S., F.I.C.
M. A. Adams, F.R.C.S., F.C.S.
C. A. Cameron, M.D., F.R.C.S., F.I.C.

Treasurer.

C. W. Heaton, F.C.S., F.I.C.

Hon. Secretaries.

G. W. Wigner, F.C.S., F.I.C.
F. Maxwell Lyte, F.C.S., F.I.C.

Other Members of Council.

A. Wynter Blyth, M.R.C.S., F.C.S.
Bernard Dyer, F.C.S., F.I.C.
Otto Hehner, F.C.S., F.I.C.
A. Bostock Hill, M.D., F.C.S., F.I.C.
T. Jamieson, F.C.S., F.I.C.
G. Jarmain, F.C.S., F.I.C.

The names of those Members of Council whose term of office has not yet expired, and who, consequently, do not retire this year, are—

A. H. Allen, F.C.S., F.I.C.
H. C. Bartlett, Ph.D., F.C.S.
A. Dupré, Ph.D., F.R.S., F.C.S., F.I.C.
J. West Knights, F.C.S., F.I.C.
J. W. Tripe, M.D.

The Scrutineers also reported that the following gentleman had been duly elected a member, viz., Mr. Hugh McCullum, Government Analyst, Hong Kong.

Mr. Adams proposed, and Mr. Wynter Blyth seconded, a vote of thanks to Mr. Heisch, for his conduct in the chair during the past year.

Mr. Heisch proposed, and Mr. Heaton seconded, a vote of thanks to the Chemical Society for the use of their rooms during the past year.

Mr. Angell moved, and Mr. Hobbs seconded, a vote of thanks to the Members of the Council for their services during the past year.

Mr. West Knights moved, and Dr. Stevenson seconded, a vote of thanks to the Water Committee.

Dr. Muter moved, and Mr. Hehner seconded, a vote of thanks to the Secretaries.

Dr. Dupré moved, and Mr. Dyer seconded, a vote of thanks to the Treasurer, which Mr. Heaton suitably acknowledged.

The Treasurer presented his accounts, audited for the past year.

Mr. W. G. Crook, Public Analyst for Norwich, was proposed as a member.

The following papers were read:—"A New Method of Testing for Alum, with Experimental Illustrations," by A. Wynter Blyth, M.R.C.S., &c.

"The Manufacture of Chloride of Sulphur," by J. Carter Bell, F.C.S., F.I.C.

After the meeting the Annual Dinner was held at the Criterion, Piccadilly, where a pleasant evening was spent by the members and their friends.

The next meeting will be held at Burlington House, on Wednesday, Feb. 15th, at 8 o'clock, when the discussion on the Water Valuation Scale, which was adjourned at the June meeting, will be resumed, and the following paper will be read: "Some Analyses of Milk which have fallen below the Society's Limit," by W. Johnstone, F.C.S.

IMPROVED PROCESSES FOR THE DETECTION OF ALUM IN FLOUR AND BREAD.

By A. Wynter Blyth, M.R.C.S., &c.

Read before the Society of Public Analysts on the 18th January, 1882.

Detection of Alum.—Neither the mere detection of alum in flour, nor as for that its estimation, presents any difficulty, for we have by the chloroform process a method of separating nearly all the alum added as alum; therefore the remarks I am about to make apply chiefly to bread, although flour was used in many of the experiments as more convenient. The logwood test, as usually applied to bread or flour, I have found wanting both in delicacy and sharpness, and this is especially the case when only small quantities of alum are present. Whether the coloured bread is dried or undried, it often happens that of two equally good observers the one calls a sample, thus coloured, dirtyish pink, the other bluish pink. Knowing the power that gelatine undoubtedly possesses of uniting with alum, I have attempted to utilise this property. A preliminary experiment was made with gelatine and pure solutions of alum. A few slips of gelatine were digested in a solution of alum of 1·10 per cent. strength for 12 hours, and the strength of the solution then ascertained. Alum withdrawn by the gelatine amounted to 15·8 per cent. A second experiment was made with a stronger solution 2·0 per cent. In 15 hours the amount of alum which had been withdrawn by the gelatine amounted to 16·9 per cent. It therefore may be anticipated that gelatine will withdraw, and as it were concentrate a considerable percentage of alum from a solution.

The next experiments were made in the staining of gelatine slips by means of ammoniacal solution of logwood, that is fresh tincture of logwood, to which an equal bulk of 10 per cent. solution of carbonate of ammonia had been added. Gelatine soaked in distilled water, in pure cold aqueous extract of flour, or aqueous extract of pure bread, becomes of a reddish brown colour without a trace of blue (see lithograph No. 1). Such a slip put into glycerine decolourizes in a few hours, and then has a dirty yellow hue. Gelatine soaked in alum solutions, in watery extracts of alumed bread or flour, becomes of a blue tint, the shades varying from lavender blue up to cobalt (see lithograph No. 2, gelatine dyed with logwood, alum, 1:10,000; No. 3, 1:7,000; No. 4, 1:1,000). More than this, the slips put into glycerine can be kept without changing colour; how long the colour thus remains I do not know, but I have some gelatine slips which

are more than a month old, and they still retain their primitive freshness. The blue tint is very distinctly seen in solutions containing one part of alum in 10,000 parts of solution, and is still demonstrable in one part in 50,000, especially if the slip is placed in glycerine and its behaviour noted. It therefore will detect one part of alum in one million parts of a solution, for such a dilute solution may be concentrated down to a smaller bulk. The application of the test is so simple that it scarcely needs description. Any convenient quantity of the bread is crumbled, put into a suitable glass vessel, and one or two little slips of dry commercial gelatine, proved to be pure by a blank experiment with distilled water, are placed with the bread, sufficient distilled water is added to well cover the mixture, and the whole is left over night. In the morning the bits of swollen gelatine are taken out and dyed with the alkaline logwood in the usual way. From some experiments it would appear that four minutes immersion is the best time, for where the proportion of alum is very minute the alumed layer appears to be only on the surface, and the dye with longer periods sinking towards the unalumed core, colours the centre reddish pink, and this pink centre, shining through the blue cortex, confuses the colour. But this statement must not be considered final, for there may possibly be some difference as to the kind of alum, whether ammonia, or potash, and also as to the strength of the logwood tincture, which future experiments will determine. Having thus obtained a method of concentrating the alum on a little strip of an almost colourless jelly, a jelly that could be coloured with the greatest ease by almost every dye, it was only natural to go farther, and to see if the alumed jellies behaved differently to the unalumed jellies. Accordingly trials were made, very generally with the aniline colours; this quite in an empirical way, for there was no theoretical likelihood of success, and as a fact, but little difference was observed.

Attention was next turned to such tinctorial agents as madder, turmeric, litmus, brazil wood, chrysophanic acid, gamboge, garancine, and many others. Of these, madder, Brazil wood, garancine, and chrysophanic acid, when the solution was made ammoniacal, all tinted the gelatine a most decidedly different hue when pure than when alumed; but the logwood was chief, both in delicacy of reaction and depth of colour, so that so far as we have gone there is nothing to equal logwood as an alum test. As for magnesia giving the same colour, it is only the soluble salts of magnesia which do this. The magnesian phosphate in bread certainly does not colour logwood, and the process to be given farther on effectually distinguishes magnesia from alum.

Excessively small quantities of alum may be detected by obtaining the phosphate of alumina in the manner to be shortly described; fusing it with sulphate of soda on a platinum dish by the blowpipe, lixivating the phosphate of soda produced, dissolving the residue with a very little dilute sulphuric acid, neutralising with ammonia. Then in this liquid, which need not be more than a cubic centimetre, steep a small bit of gelatine, and when the gelatine is sufficiently swollen and softened, it is coloured with logwood as before, and will show the reaction.

CAN ALUM BE EXTRACTED OUT OF BREAD OR FLOUR BY WATER?—It has been generally asserted that when alum is added in powder or solution to flour, and that flour is kneaded up with water or made into bread, the alum ceases to exist as alum, but forms phosphate

of alumina. That phosphate of alumina is the form in which alum appears in the ash, I freely admit; that phosphate of alumina is formed save in minute quantity in the bread itself I by no means admit, and consider it quite an open question. Take an aqueous extract of flour, filter it by the aid of a pressure pump, and add a little solution of alum, there is no precipitate; add a little phosphate of soda or potash, and a cloud is immediately perceived. Although phosphate of potash is found in the ash obtained by evaporating down to dryness, and incinerating the aqueous extract, the behaviour with solution of alum would render one doubtful of the existence of an alkaline phosphate in the watery extract were there not a simple explanation. The simple explanation is this, that phosphate of alumina is not fully thrown down from its solutions by an alkaline phosphate, except by an excess of that phosphate, so that it all depends as to the quantity of alum added, whether it is likely all to be in the state of phosphate or not. Again, if the alum is all converted into phosphate of alumina, it could hardly be washed out of bread or flour by water; but I have made some experiments which show that, by using relatively enormous masses of water, no inconsiderable quantity of alum is thus separated. But were such experiments needful?—the whole gelatine process is an ample proof of the possibility of extracting the alum from flour or bread by water, it cannot be considered possible for the gelatine to have attracted and united with such an insoluble substance as phosphate of alumina—it must be united to a soluble salt of alumina, in short, to alum itself.

Experiment.—20 parts of alum, 3,500 parts of flour, and 28,000 parts of water were mixed together, and the whole set aside for 72 hours. The flour as usual settled to the bottom, leaving a clear supernatant fluid. A fractional portion of this clear fluid was decanted, a little sodic phosphate added, and the liquid boiled slowly down to dryness in a platinum dish incinerated and the phosphate of alumina separated and determined in the way familiar to all chemists. The amount of alumina phosphate calculated on the whole as alum was 2·55 parts or 12·7 per cent. of the alum originally added. Hence in this experiment in which the proportion of water to alum was as 1,400 is to 1, over 12 per cent. of the original alum was recovered.

Experiment.—Three loaves, A, B and C, were made with a flour which was proved to be pure. Definite quantities of alum were added to two of the loaves, the third was made of the pure flour. A, 5 parts alum, 8,438 parts of flour; B, 5 parts alum, 3,503 parts of flour; C, flour 7,545 parts. In the A loaf the alum was added to the flour in powder and mixed dry with the flour. In B loaf the alum was added in solution. The loaves were fermented and baked in the usual way. Then the three loaves were cut into small pieces and soaked in three separate jars, each jar containing 49,000 parts of distilled water. After three and a half days' soaking the liquid was separated by filtration, and the residue on the filter weighed, and the necessary calculations made, so that the amount of water still adhering to the bread was known, and could be allowed for. The three filtrates were respectively evaporated to dryness after the addition of a little sodic phosphate, and the three extracts dried and incinerated, and the three ashes treated in the usual manner so as to obtain as a final result, any alumina phosphate, if present. The alumina phosphate calculated on the whole as alum separated was as follows: A yielded 1·493 parts of alum, B yielded 1·454 parts of alum, C yielded no trace. In this case then in which the water was 9,800 times the alum, the amount recovered by simple extraction with cold water was about 29 per cent.

QUANTITATIVE ESTIMATION OF ALUM.—If then by using large bulks of water it was possible to extract a portion of the alum, it was thought highly probable that by using a more powerful solvent and especially one in which any aluminic phosphate would be dissolved, most, if not all of the alum would be dissolved. It was also a question whether by this means there could not be devised a method to distinguish between alumina added as alum and alumina present as silicate of alumina. Kaolins, composed of silicates of alumina with other silicates, were taken and digested in 5 per cent. hydrochloric acid in the cold, but no alumina was found in the solution. Even a 35 per cent. hydrochloric acid, acting for 24 hours in the cold, failed to decompose the silicate of alumina. On the other hand, London clay was acted on by 5 per cent. hydrochloric acid, and parted with much iron and a minute quantity of phosphate of alumina. This is possibly derived not from a

ces,
in
ent.
nate
n to
ded

The
lum
The
ach
urs.
ead.
ina.
ence
ring
nina
een
cess
the
of
hed

as the nature of the thing permits, yet this correction no one can call perfectly satisfactory.

It may be expected that I should mention a recent case in which a difference of opinion between myself and the Somerset House laboratory appears to have arisen. A sample of bread which gave both by the old fashioned method of applying logwood a pronounced blue, and also by the gelatine method an almost cobalt blue, and finally from which sufficient alum was extracted by water, out of 250 grains, to colour blue the gelatine slip No. 5, and in which I found after allowing 12 grains of alum for 12 grains of silica (for I had not worked at that time sufficiently the hydrochloric acid process), I returned as containing nearly 19 grains of alum to the 4 lb. loaf. Now

19 grains is not much, but it is most decidedly a quantity that, having done so much work in the subject, I was not likely to make a mistake as to *the presence* of alum. However, the Somerset House chemists could find no alum in their sample, and gave a laconic certificate, "free from alum." Although I may have my own ideas on the subject I cannot swear that their sample contained alum, for there is always the possibility of unequal admixture. But what I can legitimately criticise is, the form of their certificate. There are similar referees in both France and Germany, yet in all cases the referees draw up a report stating in full all operations and experiments they have performed, and the reasons for their conclusions. It would be considered most discourteous and unprofessional in those countries, to give simply an opinion without details. If the Somerset House chemists are to take advantage of the accident of official position as referees, and to act in this way, it will be absolutely essential for the Public Analysts to take united action in a representation to the Government and press for some very decided modification of the present Sale of Food and Drugs Act.

Returning from this digression, which is scarcely germane, I must in conclusion point out clearly that I by no means pretend to have settled the hydrochloric acid process. This paper is only a preliminary note. I do not advise any one to rely upon the process until many more determinations have been made; and one of the main objects of publishing the process so early is in the hope that some of my *confrères* will take it up and for the next few months analyse all breads both by the old and the new methods and publish the results. I have to thank my assistant, Mr. Grinwood, for his very valuable and active co-operation in performing the experiments on which this paper is based.

ON THE MANUFACTURE OF CHLORIDE OF SULPHUR.

By J. Carter Bell.

Read before the Society of Public Analysts on 18th January, 1882.

This substance is now largely used in manufacturing what is called "indiarubber substitute," and though there is a considerable demand for this article and it is sold by the hundredweight, yet any one consulting the chief works upon chemistry, or the price list of some of our largest dealers in chemicals, would come to the conclusion that chloride of sulphur could only be made in small quantities, and was thus a very expensive chemical to be used on the large scale, for in one list I see the price is nine shillings a pound, and in another list it is six shillings; with large orders at the prices named, a manufacturer would soon become a millionaire, for the cost of the manufactured article is about threepence a pound.

A friend of mine requiring about half a ton of chloride of sulphur, applied to me for assistance. I consulted all the best works, and they one and all gave the same process, that of passing chlorine over melted sulphur in a retort; this is very well if only a small quantity of chloride of sulphur is required; if it has to be made by the hundredweight this process is impracticable. I therefore had to devise some method which would not require so much care and attention as the above.

For simplicity, I will divide the "modus operandi" into three parts:—the generation of the chlorine; drying the gas; passing the chlorine into flowers of sulphur.

Generation of the chlorine: I used a fifteen gallon clay vessel, which was made by the

ootter specially for this purpose; it had only one aperture, which was two inches in diameter. n having another vessel made, I should prefer to have two holes three inches in diameter, xactly like a two-necked Woulff's bottle; the vessels which are kept in stock have holes our and five inches in diameter, and also have an outlet at the bottom, these holes are nconveniently large, and as the generator is in a water bath, there is a risk of the contents f the jar finding its way into the water. The generator was put into an ordinary iron itchen boiler, water was put in, and heated by a small fire. Into the generator was put wenty-eight pounds of manganese ore in pieces of the size of a small nut, containing from 0 to 80 per cent. of binoxide of manganese. A carboy of commercial hydrochloric acid vas poured in, and the two-inch aperture closed with an indiarubber bung containing a iece of glass combustion tube bent at about an angle of 120°.

Drying the chlorine gas: A Woulff's three-necked bottle, gallon size, may be used. The ubes, if possible, should be ground into the apertures; in default of this, glass combustion ubing and indiarubber tubing slipped over the necks may be used. The sulphuric acid ottle is not absolutely necessary; when it is used, the chloride of calcium will last a much onger period without renewing. The bottle must have a safety tube. The sulphuric acid ottle is connected with a stone aspirator about five gallons in size. An indiarubber cork arrying a piece of tubing is put into the inlet at the bottom of the aspirator; the piece of ubing should be pushed through the cork into the vessel a distance of two or three inches. The aspirator must now be carefully filled with chloride of calcium in pieces about the size f small nuts, no powder must be put in; an indiarubber cork carrying a tube must now be ut in at the top aperture, which tube is connected with the vessel containing the sulphur.

Passing chlorine into sulphur: The vessels I used were wide-mouthed, blue glass allon bottles, these were fitted with good ordinary corks; indiarubber must not be used, or the chloride of sulphur acts rapidly upon such corks, making them in a short time unfit or use. It would be better to use Woulff's bottles with ground glass tubes. The bottles re now filled with dry flowers of sulphur, taking care in the filling that room is left for the as delivery tube. When the bottle is full a hole should be made to the bottom of the bottle y means of a wooden rod about $\frac{3}{4}$ of an inch diameter; if this is neglected and the elivery tube is pushed down through the sulphur, the tube becomes so filled with hardened ulphur that the gas has not a free passage. Two of these gallon bottles are connected ogether, the outlet tube of number two may be connected with an absorbing apparatus or waste gases.

The apparatus being all connected and gas tight, the water in the boiler may be raised boiling heat, chlorine is abundantly given off, and after passing through the acid and hloride of calcium, soon begins to act upon the sulphur, which becomes very hot, and bundance of chloride of sulphur is formed, which will be seen in the bottle as a dark oloured liquid with undissolved sulphur at the bottom. When the liquor has reached a trength of 136° Twaddle, a new bottle of sulphur may be put in the place of number one; hen chlorine ceases to be evolved, the spent acid may be siphoned off, and a new charge f manganese and acid introduced.

Such an apparatus, like the one described, could be fitted up for less than five pounds, nd will make at the very least one hundred pounds weight of chloride of sulphur weekly.

BEER ANALYSIS.

By J. N. Hurte.

The following analyses of our beers may be interesting to English analysts. These beers are sold here in immense quantities, with loud declarations as to their purity and general excellence.

	Milwaukee.	Lieber's.	Maus's.	Schmidt's.
Specific Gravity	1·0174	1·0229	1·018	1·0172
Extractive Matter	7·312°/o	5·988°/o	6·33°/o	5·816
Sugar	1·895	3·126	4·060	3·440
Dextrin	3·880	2·644	2·060	2·283
Albumen	·037	·016	·006	·014
Bitter matter	1·530	·202	·118	·074
Acidity as $HC_2H_3O_2$	·159	·281	·309	·080
Alcohol	5·35	9·99	5·384	4·640

Indianapolis, Indiana, U.S.A., Dec. 5th, 1881.

THE ADULTERATION OF DRUGS IN AMERICA.*

By Frederick Stearns.

The Committee on Adulteration of Drugs offer the following as their report:—

Prior to writing the report the chairman sought, from members of the Association, by circular, whatever information upon the subject each member might have to offer. The order followed in arranging this report is, first, to give the new forms of adulteration noticed in those journals to which the writer has had access during the past year, together with the means, when given, for determining the same; second, recent legislation against adulterating food and medicines; third, suggestions, criticisms and comments bearing upon the subject.

Adulterations.

Glucose.—Eleven millions of bushels of corn will be used this year in the twenty glucose factories of the United States in producing this product, most of which is employed for adulterating cane sugar and cane syrup. This amount of grain is equivalent to over one thousand car-loads per day, and when it is to be considered that the principal temptation to its production is, so far, its fraudulent use as an adulterant for true cane sugar, not easily detected, enabling the producers to reap fabulous profits therefrom, the writer thinks that it is high time that State or National legislation should compel manufacturers and mixers of this left-handed, often impure, insipid sugar to brand it, whether pure, or mixed with cane sugar, by its right name and percentage, that buyers may get what they pay for. At the last meeting of the American Pharmaceutical Association, Mr. Allaire, of this committee, very properly reported against the use of glucose, in making medicinal syrups, as a substitute for cane sugar.

Japanese Star-Anise.—Mr. Kelly, of this committee, through the kindness of Stallman & Fulton, New York, reports (with accompanying specimen) upon this article, stating that there was an arrival in New York of about fifty cases, which were, it is believed, afterwards

*Read at the Seventh Annual Convention of the Western Wholesale Drug Association, New York.

exported to London. It was offered as low as ten cents per pound. An exhaustive article on this drug appears in *New Remedies*, July, 1881, pages 199 to 202 inclusive, which is appended to this report. A synopsis of the same may be stated as follows: The genuine star-anise is a product of Cochin-China, and Siam, while the false star-anise comes from Japan, both belonging to the genus *Illiscinni*, of the N. O. Magnoliaceæ. The botanical difference in the fruit of the two is so slight as to easily deceive upon superficial examination. In taste the genuine is sweet and anise-like, the odour faintly like anise. The taste of the false is disagreeable, and not sweet or anise-like, its odour different from anise, faintly resembling laurel, camphor and nutmeg. The genuine is somewhat larger than the false, its surface more cork-like, points short, horizontal, or slightly curved upwards, further separated carpels, less woody, shrunken and wrinkled; seeds mostly dark-brown, with rounded point. Surface of the false fruit more shining and red brown; points thin, often strongly curved upwards; carpels more woody, greatly shrunken and wrinkled; seeds mostly yellowish-brown, with strong raphe and elevated point. This false star-anise is considered highly poisonous in its native habitat, and analyses by the sanitary authorities of Japan have isolated a crystalline principal as powerfully poisonous. Whether the genuine star-anise contains an identical poison in smaller proportion remains yet to be determined. Your reporter thinks it not at all improbable, for reason of the profound physiological effects of the proximate principal of the Japan star-anise, that it may in the near future become a valuable addition to the materia medica far exceeding in therapeutic value the variety which this specimen is vainly wandering around the world to substitute.

Cubebs.—The present high cost of this drug, owing to its increased use for smoking in catarrhal cigarettes, has led to fraudulent practices. The writer has recently had offered to him crushed cubebs from which the essential oil had been mostly removed by distillation.

Antimony Sulphuret.—Your reporter has seen this article offered, consisting entirely of ground, broken crockery, and anthracite coal dust.

Cascara Bark.—This new drug, the product of *Rhamnus Purschiana*, has come largely into use since its introduction to the medical profession by Parke, Davis & Co. Through the ignorance of collectors it often occurs, and has occurred repeatedly to your reporter, that large parcels of inert and worthless bark and barks of allied species are offered in place of genuine.

Mixtures.—Mr. Allaire, of this committee, reports that twice during the past year mixtures prepared for adulterating powdered drugs were offered him. He failed to obtain samples for reasons that he could not get them in less than five barrel lots. They were of three colours, red, yellow, and brown. They were offered him at 2½ to 4 cents. per pound.

Jalap.—Mr. Allaire has made several examinations of commercial powdered jalap, showing that not over 10 per cent. of the samples were up to standard. In regard to jalap, your reporter sees no reason why it should not have its market value and price established by the proper assay of each lot, as in the case of opium and cinchona.

Spruce Gum.—Your reporter detected an ingenious substitution in a lot of this article; his suspicions were excited by the fine appearance of the lot. It proved to consist of artfully prepared lumps of common resin, mixed with a small per cent. of the genuine gum, the whole being roughened by attrition.

Oil of Bay Rum.—Your reporter is informed that the so-called "smuggled" oil of bay rum is nothing but the genuine oil mixed with the oil of clove and oil of pimento, and in this condition artfully foisted upon unsuspecting parties at a price less than the imported and duty-paid oil can be sold, under the pretext that it is "probably smuggled."

Oil of Bitter Almond. (*Ess.*)—In order to introduce into market the oil now made by synthesis, and which, while it has the chemical formula of its natural analogue, is unlike it somewhat in odour, and, showing strong signs as it does of its derivative, is branded "German Oil."

Oil Ylang Ylang.—The recent great reduction in the price of this fine perfume leads to the suspicion that the reason for it lies in some ingenious sophistication not yet determined.

Ginseng.—Lilienthal Bros., of New York, report being imposed upon by ginseng fraudulently mixed with a root so closely resembling ginseng as to defy detection, unless every root was carefully broken for examination. They also found leaden plugs inserted in genuine root to add weight to it.

Rose Leaves.—Mr. Greenish (London Pharm. Soc.), calls attention to artificially-coloured rose leaves, common in the London market early this year. They prove to be petals of the pale cabbage rose, *Rosa Centifolia*, artfully dyed with coraline, or rosanaline, and dipped in perfume. They prove to be of German origin, and shipped from Hamburg to the amount of from one to three thousand pounds.

Oil of Peppermint.—J. J. Quetting & Co., New York, report finding much of this oil adulterated with oil of pennyroyal, and give us a reliable test a solution of two parts of chloral in one part of sulphuric acid, to which is added 5 per cent. of alcohol. The test mixed with the suspected oil in equal proportion gives a fine cherry colour to pure oil, and a dark, olive-green if mixed with pennyroyal.

Olive Oil and Cotton Seed Oil.—Our Consul at Naples, the Hon. B. O. Duncan, reports to the State Department that immense quantities of refined cotton seed oils are imported into Italy for the special purpose of sophisticating the native oil, for reason that it can be laid down in Naples at less than half the cost of producing pure olive oil. Hence the temptation is great to use it for mixing with pure oil for export from Italy to other countries. Its use is not easily detected except by chemical means. G. A. Buckheister (*Droguisten Zeitung*) finds that while the ordinary tests, sulphuric and nitric acids, potash, lye, ammonia, &c., produced no definite reactions, he could, by a mixture of equal parts of sulphuric and nitric acids, render visible as small an addition of cotton seed oil as ten per cent. Three parts of this test to ten parts of the suspected oil is shaken together. Pure oil gives a white colour with a greenish cast, that mixed with sesame a grass-green, and that mixed with cotton oil a paler colour. After a few minutes the liquids separate, and pure olive oil appears almost unchanged; cotton seed oil, a light brown.

Wines.—(*N. Y. Times* Paris correspondence). Out of 123 samples of wines examined at the new laboratory at the Prefecture of Police, Paris, only three were found genuine grape juice; the remainder were falsified.

Logwood.—*Le Tincturier Pratique* notes complaints about the adulteration of this dye wood with inert substances, such as molasses, sawdust, clay, &c., reinforced by sumac and chestnut extracts.

Oil Wintergreen.—Is adulterated with alcohol and chloroform, and also with oil sassafras. The first two may be detected by fractional distillation. Chloroform will make itself evident on warming a sample of suspected oil. Strong nitric acid will detect oil of sassafras, turning the sample red and throwing down a dark resinous mass. In pure oil this test leaves the oil unchanged for some time, and finally deposits white crystals of methyl nitro salicylic acid. A second method is to distil from the sample the chloroform —generally added with the sassafras to give the correct specific gravity; add to the residue one-fourth its weight of potassium hydrate solved in four parts of hot water, when the odour of the sassafras will be apparent.

Potassium Iodide.—Kasper (*Schweiz. Woch. Pharm.*) has investigated commercial iodide of potassium as to its purity, and determines it by its reaction with corrosive sublimate, a simple and easy test. His conclusions are that in the commercial state the pure salt varies from 88 to 99½ per cent.; that it should contain from 96 to 97 per cent. pure salt.

Red Cinchonas.—R. V. Mattison (*New Remedies*, October, 1881) gives the analysis of 20 specimens of commercial red barks, and states that four-fifths of the so-called red barks are nearly or quite devoid of crystallizable alkaloids; that the commercial red barks rejected by the quinine makers are absolutely worthless—that it is never a *true red* bark. No rich barks can be had at a low price. This explains why Huxham's tincture is so often found worthless, and why it is so much better when made from the popular fluid extract, for the reason that the manufacturer has to use care in making his choice of material. Out of twenty analyses, the commercial barks yielded from nil to traces, and in one instance only nearly a half per cent. quinina; of cinchonidia, etc., from nil to one and six-tenths of one per cent.; of cinchonia, etc., from nil to three per cent.

Silicate of Soda.—This has long been used as a dilutant of laundry soaps. Now the French journals announce that the silicate itself is adulterated with soap, added for the purpose of giving it a deceitful gelatinous appearance.

Salicylic Acid.—Adulterants of this salt are mentioned (*Drug Circular*, September, 1881,) as sugar, acid sulphate of potassa and cryst. sulphate of lime, starch and silica, and as accidental impurities due to imperfect washing—carbolic acid, muriatic acid, and soda salts.

False Chian Turpentine.—This drug, in its purity, has probably not existed in market to any extent at all for many years.

Linseed Oil.—Mason (Report to Liverpool Chemists' Association) says 250 tons of this oil, adulterated with neutral petroleum oil, has been sent from that port to foreign ports; that it contained about 30 per cent.; that the test is its specific gravity, and the separation of the adulterant made by converting the sample into soap, and washing this with petroleum spirit, which readily removes the mineral oil, which does not saponify.

Benzoic Acids.—Gehe states that hippuric-benzoic acid is now made from urine of cows as well as that from horses, and when so made has less characteristic odour; and further states that toluol benzoic acid is now in market at various grades and prices. Bedford (Proc. N. Y., State Pharmaceutical Associatien) states the latter has a strong odour of its derivative—nitro-benzole; and that of the imports of the past year—8,500 pounds—over 5,000 pounds of this was the urine-benzoic acid. Permanganate of potassium, added to a solution of benzoic acid neutralized with carbonate of sodium, is discharged if the benzoic acid is that from urine, but if from gum it becomes green.

To be continued in our next.

SOCIETY OF PUBLIC ANALYSTS.

Analyses of English Public Water Supplies in January, 1882. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Date when drawn.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine in Chlorides.	Phosphoric Acid in Phosphates.	Nitrogen in Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in 15 mins. at 80° Fahr.	Oxygen, Absorbed in 4 hours at 80° Fahr.	Hardness, Clark's Scale, in degrees Before Boiling.	Hardness, Clark's Scale, in degrees After Boiling.	Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
Kent Co.	Jan. 25	grsh. blue, brght.	none	1·91	trace	·34	·0031	·0096	·012	·015	19·6°	6·8°	32·6	satisfactory	Wigner & Harland.
New River	,, 15	c. f. yellow	none	1·05	trace	·29	·0014	·0028	·042	·075	15·0°	4·5°	22·7		B. Dyer.
East London ..	,, 11	p. yellow green	slight	1·27	slight	·29	·0005	·0043	·032	·086	15·0°	5·4°	24·0	satisfactory	Wigner & Harland.
Southwark & Vauxhall ..	,, 10	c. v. p. yellow	none	1·24	slight	·20	·0020	·0060	·059	·084	14·0°	4·0°	20·3	satisfactory	J. Muter.
West Middlesex	,, 14	yellowish	none	1·11	h. trace	·17	·0012	·0061	·052	·089	13·5°	3·5°	21·5	none	O. Hehner.
Grand Junction	,,	p. brown	none	1·22	trace	·16	·0020	·0078	·028	·108	15·4°	4·2°	21·8		A. Wynter-Blyth.
Lambeth	,, 10	c. v. p. yellow	none	1·24	slight	·20	·0020	·0050	·059	·075	14·0°	4·0°	21·7	satisfactory	J. Muter.
Chelsea	,, 16	p. grnsh. yell.	none	1·19	trace	·33	·0056	·0087	·050	·097	18·0°	5·5°	23·2		A. Dupré.
Birmingham ..	Jan. 12	s. turb. grensh.	none	·98	trace	·04	·0007		·011	·090	15·2°	8·0°	21·2	none	A. Hill.
Bolton	,, 13	s. turbid yellow	none	·40	none	·03	·0019	·0052	·020	·042	3·2°	3·2°	7·0	mineral and veg. debris	W. H. Watson.
Brighton	,, 9	c. blue green	slight	2·05	slight	·39	·0006	·0039	none	none	13·0°	5·2°	23·0	vegetable debris	Wigner & Harland.
Bristol	,, 16	brownish green	none	·90	none	·05	·0003	·0026	·020	·056	16·9°	1·9°	22·4	mineral and veg. debris	F. W. Stoddart.
Bury (Lan.) ..	,, 14	s. turb yellow	s. mossy	·95	none	·03	·0043	·0098	·023	·044	4·5°	4·4°	7·7	mineral and veg. debris	W. H. Watson.
Cambridge	,, 13	c. pale blue	none	1·40	slight	·56	·0005	·0015	·004	·009	16·0°	5·0°	24·3	satisfactory	J. West Knights.
Canterbury	,, 12	c. pale blue	none	1·47	none	·41	·0005	·0006	·004	·006	5·4°	3·6°	10·6	s. carb. lime	S. Harvey.
Croydon	,, 20	f. greenish	none	1·19	slight	·31	·0020	·0060	none	none	15·5°	4·5°	23·8	none	C. Heisch.
Darlington	,, 12	c. yellow	s. peaty	·84	slight	·02	·0020	·0040	·0116	·189	5·0°	4·5°	8·4	satisfactory	W. F. K. Stock.
Dublin	Dec. 30	s. yellow	none	·97	slight	traces	·0020	·0050	·004	·035	1·3°	·6°	4·5	satisfactory	C. A. Cameron.
Edinburgh	Jan. 16	s. brown	none	·64	none	trace	·0016	·0032	·016	·076	6·2°	4·9°	8·2	none	J. Falconer King.
Exeter	,, 14	f. brnsh. yellow	none	·84	slight	·15	none	·0033	·023	·040	2·8°	2·8°	7·0	none	F. P. Perkins.
Grantham	,, 18	c. p. blue	none	·98	slight	·62	·0013	·0021	·004	·006	15·7°	4·8°	22·5	diat. des. min. movg. org.	A. Ashby.
Ipswich	,, 14	c. colourless	none	2·25	trace	·24	·0044	·0052	·009	·006	19·5°	8·4°	30·7	satisfactory	J. Napier.
King's Lynn ..	,, 9	drty. mlky. wht.	earthy, offs	1·65	trace	·19	·0028	·0063	·070	·322	17·6°	5·6°	23·3	dc. vg. db., min. mtr., diat.	W. Johnstone.
Liverpool	,, 17	brownish	s. peaty	1·08	slight	·02	·0056	·0070	·052	·131	3·8°	3·4°	8·1	vegetable debris	A. Smetham.

SOCIETY OF PUBLIC ANALYSTS.

Analyses of English Public Water Supplies in January, 1882. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Date when drawn.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine in Chlorides.	Phosphoric Acid in Phosphates.	Nitrogen in Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in 15 mins. at 80° Fahr.	Oxygen, Absorbed in 4 hours at 80° Fahr.	Hardness, Clark's Scale, in degrees. Before Boiling.	Hardness, Clark's Scale, in degrees. After Boiling.	Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
Maidstone— Wtr. Company	Jan. 14	p. grnsh. blue	none	2·45	trace	·25	none	·0042	·0112	·015	21·8°	7·2°	35·8	satisfactory	M. A. Adams.
Public Conduit	„ 11	pale blue	none	2·15	trace	·40	none	·0007	·0100	·014	19·9°	7·2°	31·8	satisfactory	M. A. Adams.
Manchester....	„ 16	s. turb. f. yell.	none	·74	none	none	·0039	·0047	·021	·088	1·8°	1·8°	4·7	s. mineral	W. Thomson.
Newark	„ 14	c. grnsh. blue	none	1·12	trace	·06	·0008	·0048	·013	·031	16·7°	12·7°	35·0	satisfactory	A. Ashby.
Newcastle-on-Tyne......	„ 9	f. yellow	none	·88	trace	·04	·0010	·0070	·051	·088	16·4°	5·4°	21·7	satisfactory	J. Pattinson.
Nottingham ..	„ 13	c. grnsh. blue	none	1·42	trace	1·12	·0012	·0014	·008	·014	11·0°	7·0°	17·4	vegetable debris	Wigner & Harland
Norwich	„ 11	p. grnsh. yellow	none	1·87	trace	·02	traces	·0029	·042	·052	17·5°	4·5°	24·0	satisfactory	W. G. Crook.
Portsmouth ..	„ 19	v. s. turbid	none	1·12	trace	·25	traces	·0023	none	none	17·2°	2·0°	18·4	vegetable debris	W. J. Sykes.
Reading	„ 14	f. yellow	none	1·00	none	·14	·0009	·0056	·003	·074	14·8°	4·1°	19·2	amorphous matter	J. Shea.
Rochdale	„ 22	pale blue	none	·65	none	·01	·0020	·0030	none	·001	3·5°	3·0°	4·5	satisfactory	T. A. Collinge.
Rugby	„ 10	f. turbid	none	1·27	h. trace	·14	·0070	·0200	·030	·055	11·2°	8·6°	17·0	veg. deb., sand, infusoriæ	A. P. Smith.
Salford	„ 16	clear yellow	none	·6	none	none	·0014	·0028	·010	·039	3·5°	3·0°	5·1	none	J. Carter Bell.
Southampton ..	„ 21	c. f. grsh. yell.	none	·98	h. trace	·51	trace	·0056	·034	·097	14·8°	5·5°	21·6	satisfactory	A. Angell.
Swansea......	„ 19	clear	none	·90	trace	none	·0010	·0063	·004	·004	1·4°	1·4°	3·7	none	W. Morgan.
Warwick......	„ 21	greenish	none	1·12	none	·19	·0014	·0021	·005	·039	21·0°	13·4°	21·0	none	A. Bostock Hill.
Whitehaven ..	„ 16	c. f. green	none	·39	none	·005	none	·0007	·007	·015	·4°	·4°	2·1	satisfactory	A. Kitchin.

Abbreviations:—c., clear; f., faint; h., heavy; p., pale; v. h., very heavy; v. s., very sligh

THE PUBLIC WATER SUPPLIES OF ENGLAND.

VALUATION, ACCORDING TO "WIGNER'S VALUATION SCALE," OF THE VARIOUS WATER SUPPLIES.

In the following table we give the *average* valuation of the public water supplies reported during the twelve months of last year, and the valuation of the waters examined last month.

	Average for 1881.	January 1882.		Average for 1881.	January 1882.
LONDON— Kent	29·5	36·5	Leicester	33·1	
New River	24·7	35·0	Liverpool	36·3	48·0
East London	33·2	40·0	Llandrindod	13·0	
Southwark and			Maidstone—		
Vauxhall	34·3	44·0	Water Company	30·5	31·0
West Middlesex	33·0	40·0	,, Public Conduit	26·3	27·0
Grand Junction	30·3	41·0	Manchester	25·7	30·0
Lambeth	35·7	40·0	Newark	38·4	30·0
Chelsea	34·0	48·0	Newcastle-on-Tyne	43·6	41·0
Bath	12·0		Northampton	39·5	
Birmingham	34·6	36·0	Norwich	36·6	32·0
Bolton	22·7	27 0	Nottingham	45·6	35·0
Bradford	48·3		Oldham	23·6	
Brighton	23·9	27·0	Plymouth	28·7	
Bristol	25·1	25·0	Pontefract	171·0	
Bury	29·5	36·0	Portsmouth	27·4	25·0
Cambridge	25·3	23·0	Reading	25·8	31·0
Canterbury	16·0	15·0	Rochdale	8·4	8·0
Coventry	32 5		Rotherham	18·9	
Croydon	23·1	24·0	Rugby	47·0	45·0
Darlington	54·2	57·0	Salford	19 9	15·0
Derby	17·6		Sevenoaks	19·9	
Doncaster	35·0		Sheffield	21·4	
Droitwich	39·0		Shrewsbury	22·6	
Dublin	18·5	16·0	Southampton	42·6	44·0
Dudley	45·0		Stockport	17·4	
Edinburgh	25·9	21·0	Stourbridge	37·3	
Exeter	20·2	20·0	Stourport	27·0	
Grantham	32·9	31·0	Sunderland	25·0	
Hastings	26·2		Swansea	15·1	16·0
Huddersfield	24·3		Tunbridge Wells	35·0	
Hull	22·7		Warwick	36·1	27·0
Ipswich	27·7	29·0	Whitehaven	10·0	7·0
King's Lynn	96·6	103·0	Wolverhampton	38·7	
Leamington	25·5		Worcester	54·9	
Leeds	32·8				

We give above a list of all the towns whose water supplies have been examined and reported upon during the last year, together with the average valuation of the impurities in each supply for the year. We had intended making some remarks on the various points to which these average valuations give rise, but the pressure on our space compels us to defer our observations until next month. We also give the usual valuation of the month's supplies.

Mr. Beringer has been appointed Public Analyst for the County of Cornwall.

Mr. W. B. Harrington, F.C.S., has been appointed Public Analyst for the city of Cork, vice O'Keeffe resigned.

ANALYSTS' REPORTS.

At the Somersetshire Quarter Sessions, Dr. Alford, of Taunton, the County Analyst, reported that during the past quarter he had analysed no less than 331 samples. Among them were 57 samples of butter, 50 of tea, 25 of coffee, 47 of mustard, 18 of pepper, 11 of sugar, 2 of arrowroot, 1 of currants, 2 of confectionery, 2 of jam, 8 of spirits of nitre, 5 of glycerine, 3 of spirit of magnesia, 2 of senna, 3 of tartaric acid, 1 of carbonate of soda, and 1 of milk of sulphur. Among the samples which he had found to be adulterated were 4 samples of coffee and 11 of mustard. None of these adulterations were prejudicial to health. During the past year he had made no less than 886 analyses of food and drugs, and 54 of them he had found adulterated.

At the Monmouthshire Quarter Sessions, Major Herbert, the chief constable, stated:—"It having been reported to me that a whole family at Risca, after partaking of American tinned brawn, became seriously affected, two being in a very critical state, I instructed the sergeant at Risca to submit a portion of the meat, and also the vinegar used with it, to the County Analyst for examination. I attach his report. It clearly shows that although no adulteration was practised by the vendor, the meat was not in a healthy condition. The result of this analysis may possibly serve as a caution to both purchasers and vendors of American tinned meats."

At the City Commission of Sewers, on Tuesday, Dr. Saunders reported, as Public Analyst, that 162 samples had been analysed during the year—namely, of milk, butter, water, pepper, and sugar—but only 2 required the institution of a prosecution, both being in respect of milk. The public seemed to take very little interest in the working of the Adulteration Act, for, with a few exceptions, all the articles analysed had been obtained at his own (Dr. Saunders's) instruction by the officers of the Commission.

During the quarter ended December 31st, the Leeds Borough Analyst received the following samples for analysis:—5 of milk, 1 of butter, 2 of blackberry jam, 1 of ginger-beer, and 1 of soda-water; total 10 samples. Four of the samples of milk, the ginger-beer, and the soda-water were genuine, and of fair quality. The sample of so-called butter was found to be butterine. One of the samples of blackberry jam had a somewhat offensive smell—whether due to use of bad fruit, or to an ineffectional mode of preserving, the analysis did not show. The other sample of jam was sound, and of good quality.

LAW REPORTS.

Alum in Bread.—Dispute with Somerset House:—

Philip Keber, a baker, carrying on business at 23, Brown Street, Edgware Road, was summoned by the Vestry of Marylebone, on 30th November, for selling, to the prejudice of the purchaser, an inspector of nuisances, a 2lb. loaf of bread which was found to have been adulterated by the addition of alum. Mr. Greenwell, solicitor and vestry clerk, prosecuted; Mr. Russell, solicitor, defended. Mr. Greenwell said that the case was before the Court some time since, but was adjourned without any evidence being taken in order that the bread might be analyzed by the analyst at Somerset House. The certificate of Dr. Alexander Wynter Blyth, the Public Analyst for Marylebone, was to the effect that the sample of bread was adulterated with alum to the extent of 4·7 grains to the pound, or 18·8 grains to the 4lb. loaf. The certificate from Somerset House had been received and would be read. The chief clerk read the certificate from the Laboratory, Somerset House, signed by James Bell, Richard Bannister, and Henry James Helm, and it showed that they had analyzed the sample and declared it to be "free from alum." Mr. Greenwell urged that Dr. Blyth should be heard in support of his certificate; but Mr. Russell opposed this, as the official analyst had proved that there was no alum in the bread. Mr. Mansfield said that it was not certain the same bread was sent to Somerset House as Dr. Blyth had analysed. Mr. Russell said there could be no question as to that. Mr. Greenwell remarked that what he wished was to prevent any imputation against Dr. Blyth. Mr. Mansfield consented to hear the witnesses, and evidence was given to prove the purchase of the sample of bread. Dr. Blyth then gave the result of his analysis of the bread as shown in the certificate and explained his method of analysis. He said that of late he had made many researches as to the adulteration of bread and flour, and had made some analytical discoveries, which he had not yet published. This bread certainly was alumed, and if other people could not find the alum he could not help it. If this sample did not contain alum, it was no use his analyzing it or certifying any more samples. He had the greatest confidence that his opinion in this case was correct. In cross-examination, he said that the gentlemen at Somerset House signing the certificate were persons of ability. They might not have made a special study of

this question, as he had. He had had several prosecutions for the adulteration of bread, and had been wrong all his life if their certificate was correct. Re-examined: Alum was sometimes unequally distributed, but he could not imagine that, with that quantity of alum in the bread, it could be so unequally distributed as that other analysts would not obtain some evidence of its presence. The defendant was called, and he said that he had never had any alum in his house. He used the best flour. Mr. Mansfield said that the Legislature had placed the matter in his hands, but it was absurd to call upon a magistrate to decide a matter like this. It was a question whether this gentleman, who had made the subject a study for some time, or the gentlemen at Somerset House, who might have adopted some old-fashioned methods, were right. It was impossible for him to give a decision, and he should adjourn the summons *sine die*, and either party could bring it on again if desirous. There was a similar summons against William Parsons, baker, of 30, Lisson Street, and Mr. Russell produced a certificate from Dr. Hill Hassall to the effect that the bread contained no alum. Mr. Greenwell suggested that this summons should also be adjourned *sine die*, and said that Dr. Blyth was going to publish his researches, and the matter would undergo some public discussion. Mr. Mansfield accordingly adjourned this case also, and observed that the question was of interest to hundreds of the cleverest people in the country.—*Times*.

Selling Impoverished Milk:—

At Huddersfield, on Monday January 21st, James Dearnley, milk dealer, Dalton, was charged with selling impoverished milk, which had been impoverished by the removal of butter fat. The defendant did not appear. Mr. Kirk the sanitary inspector, stated that on the 27th ult., at his own request, Mrs. Swan, who lived in Greenhead, purchased from the defendant a quart of milk, for which he charged 3½d. She handed him four penny pieces in payment. He said he had not a half-penny, and asked her to have that extra value of milk. She took the extra milk, and then told the defendant that she had bought the milk for Mr. Kirk, the sanitary inspector. Mr. Kirk thereupon took the milk, and told the defendant what he had purchased it for. He asked the defendant if he would have a part, and at the same time offered to give him a part. The defendant made no reply, but put himself in a threatening attitude, and Mrs. Swan took the jug out of his hand and ran on to the first step of the staircase. He called Mr. John Firth, who was in the street, and he stepped between him and the defendant. He was about to get the bottles in order to divide the milk when the defendant made another attempt to get at him, and he told the defendant that he had better keep back, as he evidently seemed determined to upset the milk as he did on the last occasion. While he was engaged in the house dividing the milk the defendant came to the door and called out that he had sold it as old milk; and then said he would have a part. He told the defendant that he would have to wait until he completed the analysis, and he heard no more about him. On the 29th November he submitted a sample of the milk to Mr. Jarmain, the Borough Analyst, who gave a certificate to the effect that the milk contained of butter fat 0·78 per cent., solids not fat 8·05, and 91·17 and he was of opinion that the milk had been impoverished by the removal of 69 per cent. of butter fat, and that it contained 10 per cent. of added water. The defendant had been fined £5, £10, and £15 respectively, for similar offences, and he was now fined the full penalty of £20 and the expenses.

Jonathan Eastwood, farmer, Farnley Tyas, was summoned for having sold to the sanitary inspector a sample of milk, which was not of the nature and quality demanded by the purchaser. Mr. John Firth, assistant inspector, stated that on the 11th November he bought from the defendant a pint of milk, for which he paid 1½d. The defendant took a part which was offered to him, and said that he sold milk from his own cans at 3½d., and that he sold it at 3d., because he got it elsewhere. Mr. Kirk said he handed the sample which Mr. Firth bought to Mr. Jarmain, who had given a certificate showing that the butter fat was 2·21 per cent., solids not fat 8·73, and water 89·06; and that he was of opinion that the milk had been impoverished by the removal of 8·0 per cent. of butter fat, and 4 per cent. of added water. Defendant endeavoured to show that his son was selling new milk and he was selling old milk, which he had specially bought, and that he told purchaser at the time of purchase that it was not new milk. In reply to the Court, Mr. Ward said the defendant had been before the Bench on two occasions in reference to three similar cases, all of which were dismissed. The Bench fined the defendant £3 and the expenses.

Adulterated Milk in New York.—Thirty-four Dispensers of the Lacteal Fluid Fined for a Too Liberal Use of Croton Water:—

In the Court of Special Sessions recently Frederick Stieger was charged with adulterating milk. Sanitary Inspector Martin produced the usual evidence, and after a whispering consultation by the three presiding justices the prisoner was sentenced to pay a fine of 150 dols. This was the first of a list of

thirty-four similar offenders against the sanitary laws, whose aggregated fines netted the city treasury nearly a thousand dols. [which will more than pay the analyst his year's salary—Ed. Analyst.] The next unhappy milkman was Claus Umlandt, of No. 1,229 Third avenue. He was fined 150 dols. Charles Dusterbehen, of No. 766, Eleventh avenue, was discovered by Inspector White in his aqueous practices, and the Court fined him 50 dols. But the most original adulterator on the list was Julius Dolgner, who not only mixed with water but also sought to add a rich and pungent flavor by putting in salt with the water. Dolgner received a fine of 150 dols. and one month in the Penitentiary for his enterprise. Diedrich H. Doscher, of No. 820, Tenth avenue, escaped with a fine of 15 dols., but James McCall, whose turn came next, was assessed 25 dols.

The other cases were as follows:—

Adolph J. H. Meyer, No. 750, Tenth avenue, fined 35 dols.; Michael Rice, Fifty-fourth street, near Third avenue, fined 25 dols.; William Schmiedekamp, bond forfeited; James Alwell, No. 53, West Twenty-sixth street, fined 10 dols.; John Bryson, No. 436, West Twenty-eighth street, fined 100 dols.; Thomas Clarkin, No. 469, West Twenty-sixth street. fined 50 dols.; Rose Coffee, No. 454, West Twenty-seventh street, fined 20 dols.; Margaret Cahill, No. 448, West Twenty-seventh street, fined 25 dols.; Sarah French, fined 35 dols.; Marie Guerie, No. 427, West Twenty-sixth street, fined 15 dols.; Anton Genan, No. 338, West Twenty-sixth street, fined 25 dols.; Frederick Hegler, No. 326, West Twenty-seventh street, fined 50 dols.; Elizabeth Hill, fined 15 dols.; Henry Klee, No. 258, Tenth avenue, fined 50 dols.; Philip Lyons, No. 438, West Thirty-fourth street, fined 35 dols.; Charles W. Moys, No. 248, West Thirty-second street, fined 50 dols.; Michael McGuire, No. 235, West Twenty-seventh street, fined 15 dols.; Edward Murphy, No. 439, West Thirty-second street, fined 25 dols.; Nathaniel Owens, No. 342, West Thirty-sixth street, 25 dols.; John H. Ranges, case sent to General Sessions Court; Andrew Scherer, No. 314, West Thirty-first street, fined 150 dols.; Henry Schafer, No. 370, Seventh avenue, fined 50 dols.; Michael Swalline, No. 137, West Thirty-third street, fined 25 dols.; Patrick W. Wahren, No. 321, West Twenty-fifth street, fined 25 dols.; John F. Withers, No. 403, West Thirty-third street, fined 25 dols.—*New York Herald.*

Referring to the above report, Dr. J. Blake White writes: "The milk found on the premises of Dolgner was analyzed because it presented a very watery appearance and tasted brackish. I append the analysis, as it may prove interesting to yourself and other Public Analysts.

"Taste brackish and insipid. Appearance watery. Sp. gr. 1·029 at temp. 60° Fahr.

	Water.	Butter. Dis.	Butter. Ind.	Solids not fat.
	89·07	2·91	3·08	
Duplicate	89·06	2·95	3·16	
Average	89·065	3·02		7·915
Ash	= 1·22			

"My assistant, Mr. Munsell, determined the large amount of ash to be due to the addition of chloride of sodium. The following analysis is that of milk found in the possession of a dealer named Morlock last May, which was not only skimmed but salted also and watered:—

	Water.	Butter. Dis.	Butter. Ind.	Solids not fat.
	89·54	1·61	1·63	
Duplicate	89·57	1·59	1·61	
Average	89·555	1·61		8·835
Ash	= 1·01			

"The chief frauds practised here among milk dealers are skimming and watering, as well as both some times in same sample. Rarely we find additional salt. The fines hitherto imposed have not seemed to inspire dread of detection, but the recent disposition on the part of the Courts to imprison in addition to fining those arrested for dealing in adulterated milk, I believe will have a decided effect in checking the wholesale adulteration of milk which has long prevailed." [But we presume the State is under the necessity of paying for the support of the delinquents while they are in prison.—Ed. Analyst].

Dublin Milk—Heavy Fines:—

Thomas Kavanagh, 33, Cook Street, dairy-keeper, was summoned at the instance of Mr. David Toler, Corporation Inspector, for having sold to him a sample of new milk which Dr. Cameron certified was adulterated with 100 per cent. of added water. The defendant pleaded that the milk which was sold to Mr. Toler had been purchased from another dairy previous to the visit of the inspector. Mr. Toler informed the magistrate that this was an old excuse, and Mr. Woodlock fined the defendant £10. Mr. Fagan defended.

Sarah Molloy. "College Dairy," 12, Duke Street, was summoned by the same inspector for having sold to him a sample of new milk which Dr. Cameron certified was adulterated with 21 per cent. of added water. It transpired in evidence that the defendant was fined £6 on October 4th, for selling adulterated milk, and on the last visit of Mr. Toler she informed him that "he was very hard on the public, and that he had come very soon again." Mr. Woodlock imposed a fine of £4.

John Leonard, 23, Cook Street, was summoned by Mr. Toler for a similar offence, the milk in this instance being adulterated with 38 per cent. of added water. Mr. Toler deposed that on the 26th November he instructed a lad named Mulhall to ask for one half-penny worth of new milk at defendant's dairy. Mulhall did as he was directed, and handed the milk to him at Leonard's door. The defendant informed the inspector that it was "wholesale robbery" to send a lad like Mulhall to purchase milk on his (Mr. Toler's) behalf. In reply to Mr. Woodlock, the defendant stated that the lad Mr. Toler sent to buy the milk was a little bare-legged chap, and, judging from his appearance, he thought it was quantity and *not* quality he required, he therefore gave him skim milk. Mr. Woodlock, who remarked that that was the queerest defence he ever heard, fined the defendant £7.

Thomas Clitheroe, dairyman, 116, Lower Gardiner Street, was also summoned by Mr. Toler for having sold a quantity of new milk, in pursuance of a contract, to the Governors of the Westmoreland Lock Hospital, Townsend Street. Mr. Toler deposed that on the 11th of November he attended at the above institution, and obtained a sample of new milk from the supply which the servant of Thomas Clitheroe was delivering to the Hospital for the use of the patients, in pursuance of a contract. This milk Dr. Cameron certified was adulterated with 16 per cent. of added water. Mr. Toler also deposed that on the same day he purchased a sample of milk from a separate can supplied by Clitheroe for the Hospital matron; this milk, however, was found to be of a *pure* quality. Mr. Woodlock imposed a fine of £5, remarking that it was a perfectly scandalous system of trading, and added that Clitheroe should consider himself safe that he was not fined £20. Mr. McSheeley, Law Agent to the Corporation, prosecuted in each case.

RECENT CHEMICAL PATENTS.

The following specifications have been recently published, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

No. 1881	Name of Patentee.	Title of Patent.	Price
2097	R. Hall	Substitute for Coffee	2d.
2306	W. R. Lake	Manufacture of Manure	2d.
2369	S. Cohné	Electric Lamp	4d.
2391	E. Solvay	Treatment of Phosphate of Lime	4d.
2402	G. Hawkes and E. Bowman	Electric Lamps	8d.
2423	W. L. Wise	Treatment of Organic Substances for Production of Ammonia	6d.
2492	P. Jensen	Electric Lamps	8d.
2495	E. G. Brewer	Electric Arc Lights	6d.
2524	J. H. Johnson	Manufacture and Purification of Gas	6d.
2563	G. G. André	Electric Lamps	6d.
2572	H. E. Newton	Electric Lamps	6d.
2575	W. E. Gedge	Manufacture of Baryta	4d.
2580	J. Webster	Producing Alumina	4d.
2589	F. Lux	Desulphuration of Liquids and Gases	4d.
2812	W. Crookes	Electric Lamps	4d.
3864	S. Pitt	Preparing Compounds of Nitrocellulose or Pyroxyline	6d.
4617	A. M. Clark	Electric Lamps	6d.

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; Journal of Applied Science; The Provisioner; The Practitioner; New Remedies; Proceedings of the American Chemical Society; Le Practicien; The Inventors' Record; New York Public Health; The Scientific American; Society of Arts Journal; Sanitary Engineer of New York; The Chemists' Journal; Oil and Drug News; Sugar Cane; Country Brewers' Gazette; The Medical Record; Oil and Drug Journal; The Canada Lancet; Gas and Water Engineering.

THE ANALYST.

MARCH, 1882.

SOCIETY OF PUBLIC ANALYSTS.

An Ordinary General Meeting of this Society was held on the 15th February at Burlington House, Piccadilly; the President, Mr. Heisch, in the chair.

The minutes of the previous meeting were read and confirmed.

On the ballot papers being opened, it was reported that Mr. W. G. Crook, Public Analyst for Norwich, had been duly elected a member.

The following papers were read and discussed:—

"Some Analyses of Milk which have Fallen Below the Society's Limit," by W. Johnstone, F.C.S.

"Notes of Some Experiments on the Action of Organic Matter on Silver Salts," by H. Leffmann, M.D.

The discussion "On the Water Valuation Scale" which was adjourned at the meeting in June last, was to have been resumed at this meeting, but owing to the lateness of the hour, it was again postponed until the March meeting; and on the proposition of Dr. Muter, the President was requested to send a circular to every member of the Society resident in the United Kingdom, setting forth all that had taken place on the subject, and asking each member to express his opinion for or against the adoption of a Water Scale by the Society, with his reasons therefor, and stating that the replies received should be held to represent the presence and votes of the members so replying at the London meeting.

The next meeting of the Society will be held at Burlington House, on Wednesday, the 15th March, when the following papers will be read:—

"On Milk Analysis," by P. Vieth, F.C.S., &c.

"Some Points in Milk Analysis," by Otto Hehner, F.C.S., &c.

"The Action of Sulphuretted Hydrogen upon Compounds containing Oxide of Iron," by J. Carter Bell, F.C.S., &c.

The letters received by the President in reply to the circular relating to the "Water Valuation Scale" will be opened and read.

NOTES OF SOME EXPERIMENTS ON THE ACTION OF ORGANIC MATTER ON SILVER SALTS.

By Henry Leffmann, M.D., Microscopist to the Pennsylvania State Board of Agriculture.

Read before the Society of Public Analysts, on 15th February, 1882.

The action of organic matter upon silver salts is well known, but I am not aware of any attempts to utilize this method for the examination of water. The following experiments

were undertaken as a sort of preliminary investigation. The subject of water analysis is so important, and so much remains to be done, that every observation of the kind must have some value.

If we add a salt of silver to ordinary water, the precipitated chloride interferes with the test, and to prevent this, I used a solution containing marked excess of ammonia. In the following experiments, the proportion used was 2 c.c. of ammonio-nitrate of silver to 100 c.c. of the water. The silver solution contained only a few grains to the ounce. When not otherwise mentioned, the water was exposed to the sunlight for two hours.

1.	Distilled water	No colour.
2.	Schuylkill "	"
3.	Ditto " with 0·1 c.c. urine	Brown colour.
4.	Ditto " with 0·5 c.c. urine	Deep brown.
5.	Ditto " with 0.02 c.c. urine	Red brown.
6.	Ditto " with 4 grs. raw sugar	No colour.
7.	Ditto " with 2 grs. stale mash	Yellowish.
8.	Well water, not perfectly pure, but not unfit to drink ..	Faint black.
9.	Ditto " markedly contaminated	Black precipitate almost immediately.
10.	Water from a small stream, quite pure	No colour.

Waters containing small amounts of milk, glucose and albumin gave no distinct effects. Solution of glue produced a faint brown. All the experiments tended to show that the test was very sensitive to the presence of urine. Some experiments were made with highly dilute solutions of the common active principles.

Quinidia, strychnia and cinchonidia gave no result. Picrotoxin gave light yellow. Caffeine gave light yellow. Quinidine sulphate gave faint brown. Morphia gave immediate precipitate.

I hope to present before long the results of some further study of the matter.

SAMPLES OF MILK WHICH HAVE FALLEN BELOW THE SOCIETY'S LIMIT.

By William Johnstone, F.I.C., F.C.S., Public Analyst for the Borough of King's Lynn.

Read before the Society of Public Analysts on 15th February, 1882.

There has been much written upon milk analysis, and the results obtained vary so much that I think I am warranted in making a few observations upon the result I have personally obtained as a Public Analyst, as they differ materially from the limit adopted by the Society of Public Analysts; therefore, I think it will not be out of place to lay a few of the results so obtained before the Society. The process I adopt for the extraction of the fat is described in the *Chemical News*, Vol. XLIII. No. 1,121, and differs in no essential point, except that I have discontinued the use of the stoppered extraction tube, and adopted that invented by Professor Soxhlet. The total solids I determine in a separate 10 grm. of the milk evaporated to dryness in the water-bath, and then heated to a temperature of 110° C. in the air-bath until the weight is constant. The following analyses are the results obtained from four samples of milk which were taken by the inspector on 29th July, 1881. The figures represent the average of duplicate analyses :—

Total solids	12·850	13·169	12·325	13·085
Fat	3·182	4·716	3·995	4·258
Solids not fat	8·668	8·453	8·330	8·777
Ash	0·734	0·633	0·670	0·770
Sp. gr.	1030·0	1029·0	1029·4	1032·3

I was unable at the time to make arrangements to see the cows milked, but from careful enquiries made, I have every reason to believe the above milks were genuine, and the milk of several cows. However, to give the benefit of the doubt to the limit adopted by the Society, I shall now quote the actual figures of duplicate analyses of two samples taken by the inspector on the 8th December, 1881 :—

	1		Average.	2		Average.
Total solids ..	12·30	12·29	12·29	12·42	12·48	12·45
Fat	4·02	3·93	3·97	3·94	4·12	4·03
Solids not fat ..	8·28	8·36	8·32	8·49	8·36	8·42
Ash	0·770	0·73	0·75	0·686	0·713	0·74
Sp. gr.	1030·6	1030·6		1029·7	1029·7	

After considerable hesitation I determined to report the above samples adulterated, so as to be able to ask the magistrate to grant an order to see the cows milked if the defendants pleaded not guilty. Happily the summonses were not issued as the vendors both consented to allow the cows to be milked in the presence of an officer, and also gave the following details as regards the feeding of the cows and the number that supplied the milk.

No. 1 was the milk of four cows: they received ordinary feeding along with a considerable quantity of mangolds. No. 2 was the milk of 10 cows fed on grains, malt combs, turnips, mangolds, cake, and long hay.

On the 31st December, 1881, an officer was sent to No. 1 dairy, saw the cows milked, and the milk emptied into a large vessel; he then took a sample, and the following are the results of duplicate analyses :—

			Average.
Total solids	13·865	13·920	13·89
Fat	5·529	5·511	5·52
Solids not fat	8·336	8·409	8·37
	*8·320	8·410	8·36
Ash	0·780	0·786	0·78
Sp. gr.	1029·2	1029·2	

* Solids not fat found upon drying residue in platinum boat.

The above sample of milk was taken after the milk of five cows had been mixed.

On the 30th January I personally called at the dairy and asked the proprietor if he would allow me to witness his cows milked, and also to allow me to take a sample of each cow's milk; he readily consented, and the following are the average results of duplicate analyses of each milk :—

	1	2	3	4	5	6	7	8 Mixed milk.
Total solids	13·547	11·960	11·851	12·856	12·884	11·891	14·268	12·526
Fat ..	5·495	3·728	3·653	4·265	4·565	2·745	4·541	4·299
Solids not fat	8·052	8·232	8·198	8·591	8.319	9·146	9·727	8·227
Ash ..	0·647	0·726	0·708	0·799	0·731	0·765	0·746	0·752
Sp. gr. ..	1027·8	1029·1	1029·	1029·9	1029·9	1031·4	1033·8	1030·7

I was also furnished with the following details :—

Cow No. 1.—Calved in last week of November, or first week of December. Pedigree breed.

Cow No. 2.—Calved a week after No. 1, about 5th December.

Cow No. 3.—Calved a week after Christmas; its first calf; and itself a calf of No. 1.

Cow No. 4.—Calved last August.

Cow No. 5.—Ditto.

Cow No. 6.—Calved the week before Christmas.

Cow No. 7.—Calved 23rd January, 1882.

For a fortnight previous to the 30th January the cows have all been fed on turnips, grains, and long hay. Cows Nos. 1, 2, 4, and 5 compose milk taken on 8th December, 1881; then fed on mangolds, grains and hay.

Cows No. 1, 2, 3, 4 and 5 compose milk taken on 31st December, 1881.

Cows Nos. 1 to 7 compose milk taken on 30th January, 1882.

On the 31st December, 1881, an officer was also sent to dairy No. 2, saw the cows milked, the milk emptied into one large vessel, took a sample, and the following are the results obtained :—

			Average.
Total solids	12·505	12·453	12·479
Fat	3·955	3·974	3·964
Solids not fat	8·550	8·479	8·514
	*8·570	8·476	8·520
Ash	0·706	0·710	0·708
Sp. gr.	1029·5	1029·5	

* Solids not fat obtained upon drying residue in platinum boat.

On the 2nd February I personally called at dairy No. 2, explained my object, made the same request as to samples, saw the cows milked, the milk emptied into a large wooden vessel, took a sample, and the following are the averages of duplicate analyses :—

	1	2	3	4	5	6
Total solids	11·398	11·408	14·122	12·472	13·764	12·288
Fat	2·773	2·973	4·784	2·966	5·174	3·699
Solids not fat	8·625	8·435	9·348	9·506	8·590	8·589
Ash	·792	·769	·826	·774	·761	·792
Sp. gr.	1028·6	1029·2	1030·9	1029·4	1030·4	1033 4

	7	8	9	10	11	12 Mixed milk.
Total solids	14·059	12·288	13·646	12·910	12·330	12·789
Fat	4·457	3·083	4·607	3·866	3·515	3·574
Solids not fat	9·632	9·205	9·039	9·044	8·815	9,215
Ash	·803	·742	·852	·716	·720	·766
Sp. gr.	1032·9	1033·1	1032·0	1030·8	1030·8	1031·5

The results of analysis of the milks of these 18 cows, which are genuine beyond doubt, the solids not fat in 10 instances fell considerably below the standard adopted by the Society. They are certainly the milk of individual cows, but that cannot be said in regard to the mixed sample from dairy No. 1, where out of seven cows only two came up to the standard. Also as regards the mixed sample from dairy No. 2, containing the milk of eleven cows, five of which fell below the Society's standard of solids not fat, and two below 11·5 per cent. of total solids.

The foregoing analyses illustrate what has frequently been pointed out before by several members of the Society—namely, the variability of the composition of milk. That individual cows are occasionally met with (and I have met with them in this case) whose milk give startling results I admit, but it should be borne in mind that the samples collected on the 31st December are not the milk of two individual cows poorly fed, but that of five and ten respectively, and that the poorness in solids not fat cannot be attributed to bad feeding.

In judging a milk upon the analytical results as to whether it has been tampered with or not, the proportion of fat in conjunction with the other constituents should be carefully considered before giving a definite opinion as to the genuineness of the sample. In cases such as the above, I think the analyst is justified in reporting the sample adulterated; as the alternative is always left, that, if the vendor refuses to allow the cows to be milked before trial, or pleads not guilty, the analyst can apply to the magistrate to grant an order to see the cows milked. If such a plan were more generally adopted in suspicious cases, the truth would soon be arrived at. However, until the legislature fix a standard of fat, and *solids not fat*, milk prosecutions in doubtful cases will be far from satisfactory.

The President said that so far from being surprised at Mr. Johnstone's finding *some* milks which fell below the Society's standard, he wondered that Mr. Johnstone ever found any which came up to it. If he kept his samples at 110° C. till they ceased to lose weight, the greater part of the milk sugar must be decomposed. The Society's standard is for milks dried at 212° F. From the amount of fat the sp. gr. and the ash, Mr. Johnstone's samples appeared to be good milks, and had they been dried, as is usual, at 212° F., he believed very different results would have been obtained. He, the President, should strongly object to the paper being published with its present heading of "Samples of Milk which have Fallen Below the Society's Limit," because they had not been examined according to the Society's method.

Mr. Hehner said he wished to echo what had fallen from the President. At 100°C. milk sugar loses part of its water, the loss amounting to about 5 per cent. if one molecule of water was driven off. He would certainly expect to find the solids not fat from three to four-tenths of a percentage too low if the milk was dried to constant weight. Milk sugar changed in several physical respects, such as specific rotatory power, on being heated for some length of time, as had recently been shown by Mr. Schmoeger (*Berl. Ber.* 1881). A very striking point in Mr. Johnstone's analyses was the non-agreement between the specific gravity and the total solids or solids not fat; in every case the specific gravity was that of genuine milk, and he held that it was quite impossible to find low solids not fat and normal specific gravity. This discrepancy ran through the whole of the analyses. In addition to this the amount of ash was normal in all cases but one, whilst one would have expected with the fall of the solids not fat a corresponding fall of the ash. The specific gravity and the ash utterly contradicted the results of the solids not fat.

Dr. Muter strongly confirmed the President's remarks as regarded milk sugar. Sometime ago, when he was elaborating his process for the estimation of cane sugar in milk, he had occasion to make many experiments on milk sugar, and he knew very well that even at 100° C. it began to lose appreciably. That was what always caused the slight difference and rendered it impossible to get an accurate estimation of both sugars in milk within one per cent. or so. If the milk sugar were dried above 100° C., then the decomposition was still more pronounced. Another point was as to the time which had elapsed between the taking of the samples and the analysis. In perfectly fresh milk from the cow one might perhaps venture to dry more boldly; but, if it had stood a little and developed the slightest acidity, then high temperature drying would be still more dangerous. Referring to the title of the paper, Dr. Muter said it was not what it should be, because they could not consider the Society's standard applicable to any milk analysis unless it had been made exactly in the way the Society intended, namely, by drying a small quantity as rapidly as possible at 212° F., extracting the dry residue with ether or light petroleum, and then rapidly drying the "solids not fat" remaining also at 212° F. Referring to the possible loss of solids not fat by keeping, Dr. Muter said that, now many years ago, he had made a large number of experiments to find if any rule could be laid down as to the rate of decomposition, but it was impossible to ever come near the truth, as no two milks behaved alike even when kept under similar conditions; and although he then laid down a sort of fair average, which had since been practically adopted at Somerset House as the result of their trials which agree apparently with his, yet it was really a most illusory matter, frequently leading to great

injustice to the analyst who worked on the fresh sample. A curious fact, however, was that in some milks the first step of loss was more sudden than what occurred afterwards; so that, in any experiments tending to either establish or invalidate a standard, the milk should be taken as fresh as possible to get reliable results. In conclusion Dr. Muter said that no experienced analyst ever adopted a hard and fast standard of condemnation, but took every point into consideration, and many milks passed through his hands where the solids not fat fell a trifle under 9 per cent., but were not yet condemned because the fat was exceptionally high, as in the cases quoted to-night, or for some other reason which might occur to his mind, on studying the constitution of the article as shown by the figures obtained. Given, however, everything else concordant, then 9 per cent. was a fair and just standard of calculation, and ought not to be lowered on account of exceptional cases like the present.

Dr. Bartlett said it appeared to him that Mr. Johnstone had not been operating in the same way to which they had been accustomed. The results given were no doubt those which had been obtained, but from a certain amount of experience gained from some years in analysing large quantities of samples, he (Dr. Bartlett) had not found any such results accompanying the process by which they had been accustomed to derive their results. He had also noticed the discrepancy between the sp. gr. and the other results referred to by previous speakers. In one case the fat is supposed to represent 4·54, and the solids not fat 9·73. Taking the column to the left of that, the fat was represented by 2·75, which was very considerably lower, and the solids not fat 9·15, and also the ash had a little increased, but the sp. gr. of the one was 1031·9, and of the other 1033·8. If they took the 2·75 and 9·15 and added them to the water, they would get at the theoretical sp. gr. which was as easily worked out as the original gravity of beers. If Mr. Johnstone did that and compared it with the other he would find it actually impossible to get these discrepancies in the sp. gr. He would like to ask Mr. Johnstone if he had determined the total solids by themselves at 110° C.? Having extracted the fat, had he determined the solids not fat at that temperature, and then had he determined the total solids at the temperature which is 100° C. or 212° F., and if so, were those results in accordance with the previous ones, particularly when the total results were compared? A most important feature in his (the speaker's) experience was that there might be a double error—one correcting the other. He had found the oxidation of the fat had increased the weight when such a temperature as that mentioned was used, and the same high temperature would have decreased the solids not fat by the loss of the constituent water of the milk sugar. The opinions he had expressed were based upon analyses made on a large number of samples of milk, which were so nearly constituted in their results—not of each cow, but of large and small dairies supplying a condensed milk company—that they were able to put their fingers upon any dairy where any admixture of water had taken place, and were frequently told that the difficulty arose from the peculiar breed of the cow, or the time of breeding, or the time of day when the milking took place; and whenever they did find anything that could be depended on, it was that the cows were diseased, or were unfit for milking, if the results of the analyses did not come well within the standards since adopted by the Society of Public Analysts.

Mr. Wigner pointed out that the fat was in every case too high, and the solids not fat too low; had these samples been put in his hands he should have asserted that the fat had

been extracted by ether containing alcohol, and some of the milk sugar taken away. He also concurred in what had been said about drying at 110°C. as such a deviation from the Society's method that he did not think the analyses could be at all compared.

Mr. Johnstone, in reply, said that the analyses were all commenced within two hours after the cows had been milked. The total residues were all dried at 100° C. and weighed. He invariably found throughout the whole analysis that if dried at 100° C. and then at 110° C. the decrease never exceeded 0·2 per cent., and in proof of that he gave the results obtained in the different weighings in the duplicate analyses made of the two samples of milk taken on 31st December, 1881:—

Dried at 100° C. for 3½ hours	14·135	14·248	12·903	12·900
Do. 4 "	14·045	14·238	12·785	12·750
Do. 5 "	13·974	14·050	12·716	12·666
Do. 6 "	13·905	14·000	12·650	12·630
Dried at 110° C. for 2 "	13·900	13·983	12·610	12·546
Do. 3 "	13·885	13·950	12·530	12·490
Do. 4 "	13·865	13·920	12·505	12·453

It took from four to six hours to dry the total solids, and the following are the results so obtained from the samples collected on 30th January when dried at 100° C. for six hours:—

1	2	3	4	5	6	7	8
13·647	12·086	11·972	13·030	12·992	12·070	14·518	12·620

He used the best methylated ether he could obtain for the extraction, having been previously rectified before use. The platinum boats or elongated basins were bodily inserted into a large test tube, with perforated bottom previously plugged with cotton (so as to act the part of a filter), the whole inserted into Soxhlet's fat extraction apparatus also containing cotton, and the extraction completed in this way; the ether was twice filtered through cotton before returning to the weighed flask. He determined the total solids, then took another part evaporated to dryness, extracted the fat and weighed. He found that by weighing the fat, then the solids not fat, and adding them together, the total so obtained sometimes exceeded the total solids found, but in no instance to a greater extent than 0·25 per cent., the increase in weight being probably due to an oxidation of the fat, as he sometimes found a decided gain in weight upon prolonged drying of the fat.

CHINESE METHOD OF MANUFACTURING VERMILION.

By Hugh Mac Callum.

There are three vermilion works in Hong Kong, the method of manufacture being exactly the same in each. The largest works consume about six thousand bottles of mercury annually, and it was in this one that the following operations were witnessed:—

First Step.—A large, very thin iron pan, containing a weighed quantity, about 14 pounds, of sulphur, is placed over a slow fire, and two-thirds of a bottle of mercury added; as soon as the sulphur begins to melt the mixture is vigorously stirred with an iron stirrer until it assumes a black pulverulent appearance with some melted sulphur floating on the surface; it is then removed from the fire and the remainder of the bottle of mercury added, the whole well stirred. A little water is now poured over the mass, which rapidly cools it; the pan is immediately emptied, when it is again ready for the next batch. The whole operation does not last more than ten minutes. The resulting black powder is not a definite sulphide, as uncombined mercury can be seen throughout the whole mass; besides, the quantity of sulphur used is much in excess of the amount required to form mercuric sulphide.

Second Step.—The black powder obtained in the first step is placed in a semi-hemispherical iron pan, built in with brick, and having a fireplace beneath, covered over with broken pieces of porcelain. These are built up in a loose porous manner, so as to fill another semi-hemispherical iron pan, which is then placed over the fixed one and securely luted with clay, a large stone being placed on the top of it to assist in keeping it in its place. The fire is then lighted and kept up for sixteen hours. The whole is then allowed to cool. When the top pan is removed the vermilion, together with the greater part of the broken porcelain, is attached to it in a coherent mass, which is easily separated nto its component parts. The surfaces of the vermilion which were attached to the Porcelain, have a brownish-red and polished appearance, the broken surfaces being somewhat brighter and crystalline.

Third Step.—The sublimed mass obtained in the second step is pounded in a mortar to a coarse powder, and then ground with water between two stones, somewhat after the manner of grinding corn. The resulting semi-fluid mass is transferred to large vats of water, and allowed to settle, the supernatant water removed, and the sediment dried at a gentle heat; when dry, it is again powdered, passed through a sieve and is then fit for the market.—*Oil and Drug News.*

THE ADULTERATION OF DRUGS IN AMERICA.

[CONCLUDED.]

Solution Citrate Magnesia.—Classen (*New Remedies*, October, 1881,) traces the reason why there is no precipitate in this solution, as made by a popular New York manufacturer, to the fact that it has no magnesia in it, but consists of sodium tartrate.

Orange and Lemon Oils.—It is reported that the cheapness of ess. oils orange, lemon and bergamot, made in Messina, Italy, is not so much due to the use of improved methods and apparatus as it is to a way they have of rectifying the French spirit of turpentine, and obtaining a fragrant non-oxidized product from it that admits of free admixture with the ess. oils without ready detection.

Essential Oils Adulterated with Alcohol.—Drechsler (*Zeitch. F.*, Anal. Chem.) employs a test—a solution of potassium bichromate, one part, in nitric acid (sp. gr. 1·30) ten parts. Alcohol is betrayed by the odour given off of ethyl nitrate.

Bismuth Subnitrate.—Vitali (*Bulletino Farm*), reports meeting this contaminated with calcium phosphate as an adulterant.

Coriander Ess. Oil—Bergamot Ess. Oil.—Both are adulterated with colourless rectified oil orange, on account of lower cost of the latter, and may be detected by its insolubility in 95 per cent. alcohol. The pure oils dissolve in all proportions; the mixed ones make a turbid mixture.

Caraway Seed Oil.—Is adulterated with ess. oil derived from caraway chaff, and this chaff oil is first mixed with rectified spirits of turpentine. This can be detected by the same test as foregoing.

Saffron.—Grispo (*Jour. Phar. D'Anvers*, February, 1881), has analysed a factitious saffron, and found vegetable filaments of unknown origin, with water, glucose, and baryene. Kanoldt (*Pharm. Zig.*, No. 34) has examined a factitious saffron that consisted entirely of an alga, probably *Fucus amylaceus*, which had been weighted with a coloured mixture of chalk and honey.

Beeswax Adulterations.—Jean (*Chem. Zeitung*, No. 34), recommends the following tests for wax:—

For water—Knead the wax with well-dried copper sulphate, which will give a blue colour.

For mineral and starchy matters—Solve in turpentine; these remain unsolved.

Sulphur—By igniting, when sulphurous acid gas is given off. Resin gives to wax a terebinthinate odour, and makes it adhere to the teeth if chewed. Paraffin makes the wax brittle, and lowers its melting point. Lard is indicated by fatty odour and touch.

Ipecac. Powdered.—Mrs. Stowell (*Microscope*, April, 1881), reports upon microscopical examination of this drug, and of finding potato starch in every specimen she examined, and two had cornmeal in them.

Catechu.—Jossart (*Jour. Phar. D'Anvers*, Feb. 1881), has observed catechu which contained from 60 to 70 per cent. of ferrous carbonate.

Wines and Liquors.—Leffmann (*Medical Times*, July 16th), restates his opinion that the adulterations used in falsifying and fabricating these articles are no more harmful than are the true articles, but lays stress upon the fact that they are commercial frauds, and so reprehensible. The chairman of your committee has always insisted that the adulterations of liquors were of little moment as poisons, or as injurious, for reasons that the poison of the whole class lies in its alcohol, and not in its natural or artificially added flavour or odour. In its social aspects, the adulteration of liquors is offensive, for reasons that no sophisticated wine or liquor can or does have the flavour or bonquet of even the poorer naturally flavoured ones. In their relations to medicines, sophisticated and adulterated wines and liquors, while commercial frauds, and to be so treated, are not fatal as poisons except inasmuch as the alcohol they contain is so. What the public require and need, as he apprehends it, is that if they pay for natural wines and spirits, they want what they pay for, and that only.

ADULTERATION OF DRUGS IN ENGLAND.

The Society of Public Analysts report that the percentage of adulteration of drugs examined in 1880 was 16 per cent., against 28 per cent. in 1879. In most case the pharmacists were not the delinquents. Many of the instances were of paregoric destitute of opium, sold by small shopkeepers who were not pharmacists, and therefore, prohibited by the British Pharmacy Act from dealing in an article containing poison. A curious distinction —the shopkeeper may sell paregoric without opium, while the pharmacist must sell paregoric with opium.

Sodium Bi-carbonate.—Roster (Arch. D., Pharm. July, 1880), finds that this salt made by the Leblanc's so-called American process, while it stood all the tests of the German Pharmacopœia, was found to contain nearly 4 per cent. of ammonium bi-carbonate.

Asafœtida.—Dr. J. Muter reports this drug adulterated by dropping properly formed pieces of magnesian lime stone into melted asafœtida. It possessed outwardly an excellent appearance, but consisted of 79 per cent. of limestone.

Pea Nut Oil—Is largely used for adulterating chocolate.

Peru Balsam.—Fluckiger (*Pharm. Zeitung*, 1881) says that this balsam has, for many years, in Hamburg, been adulterated with rosin, benzoin, styrax, copaiba, and even castor oil, and mixtures of these substances. He bases his test upon, first, its specific gravity, which at 15 degrees cent. must be between 1·140 and 1·145; second, ten drops of balsam produce, with four-tenths gram of slaked lime, a mixture which remains soft and does not harden; and, third, when shaken with three times its weight of carbon bi-sulphide, the balsam is separated into dark-brown resin, which clings to the glass, and should be about one-third its weight; and cinnamein which imparts but little colour to the carbon bi-sulphide.

Corks.—Old, and once used, are collected and bleached with sulphurous acid and recut.

Copaiba—Is reported to be adulterated with gurjun oil, but the writer thinks it improbable, for reasons of the high quoted price of the latter.

Quebracho.—Hitherto only the bark of the older and stronger trees have been imported, while that of the younger is better, containing a much higher percentage of active matter.

Potassium Bromide.—Maschke (*Pharm. Zeit.*) finds this contaminated with lead, which is detected by ammonium sulphide, but not by sulphuric acid.

Commercial bromide should contain not less than 98 per cent. of pure bromide, the balance being chloride, sulphate or carbonate of potash, without any bromates or iodides.

COMMENT.

Your reporter does not find recorded in the medical press of this year as many instances of adulterated drugs as one would be led to believe have become prominent and notorious. It is asserted that the American market is one crowded by imports of drugs of low grades, or at least grades lower than those authorized in the official and standard works on materia medica.

The writer is not prepared to admit such assertions to be true, believing as he does that there is in this country a demand as well as abundant supply of crude foreign drugs of high grades, and that the intelligent purchaser can generally find his wants for such high grades easily and promptly met.

London, which is the drug receiving as well as drug distributing centre of the world, has a well defined system of grading all drugs received from foreign ports, a system which probably has its analogue in this country in the grading of grain. So far as the writer can judge from his private experience and from published drug price lists, as well as those of importers and jobbers, no like system of grading obtains in this country.

The manufacturer and large buyer who is constantly in the market, if an expert, can control the relation between quality and price in his purchases, but to the moderate buyer, opium is simply opium, and whether it contains 5 per cent. or 15 per cent. of morphia, he is alike uninformed by its price or by any grade established before it is offered for sale. It seems to the writer important that every importation of drugs should be in some way graded, and its grade branded on each parcel in such a way that the least expert when buying shall know by official seal just what he is paying for. It seems to the writer as if it would be impossible to fix a legal standard for crude medicines, save one that shall be somewhat flexible and adjustable to the general average of good drugs, or one that shall establish certain grades based upon each drug having a fixed percentage of active matter. Many drugs are imported lower than the official standards, but which have a legitimate and proper value. For instance, cpium for medicinal use, as opium and its galenical preparations, should have a fixed morphiometrical strength, but that is no reason why opium of higher or very much lower morphio percentage should not be used by the manufacturing chemist for the manufacture of morphine, provided he finds the relation of its cost to its morphio yielding value profitable to him.

Again, take the cinchonas. While it is imperative that the barks swallowed in substance are used in making the official tinctures, should have a fixed and high quinia-alkaloid standard, it does not follow but that lower grades may be legitimately and profitably used by the manufacturers of the cinchona alkaloids, and it seems that there is a legitimate use for still lower grades of cinchona barks in replacing the simple tonics like gentian and colombo, for it must be conceded that the cinchona barks that contain, perhaps, nothing more than the cincho-tannates, must be better tonics than the simple bitters.

What, therefore, the writer thinks is greatly needed in this country in the primary markets and ports of entry for foreign drugs, is a rigid official system of grading drugs, which shall insure to the buyer expert knowledge of what he pays for, and not the arbitrary exclusion of all drugs which shall not conform to high official standards.

In the execution of the newly-passed Acts to prevent adulteration of food and medicine, it is not unlikely that with the appointment thereunder of an army of examiners,

analysts, and other officials, spurred on by zeal to make their official acts show ample results, will overdo the matter oftentimes, as has been notably the result under similar recent legislation in Great Britain, and that many a poor grocer and still poorer pharmacist shall be made to feel the heavy arm of the law he has unwittingly and unintentionally violated. It must not be forgotten that in establishing these laws adapted to communities only of almost Utopian perfection, they have to apply in fact to a vast army of merchants in a country yet new and crude, whose preliminary drill and education in nowise compares to the standard implied and demanded from those these laws affect. One great reason why, heretofore, it has been so difficult to get favourable action from proposed pharmacy laws in the State Legislatures has been a distrust among legislators of this kind of class legislation. It is also a common experience, that unless legislative enactments are in accordance with the needs of an overwhelming majority of the people, they simply encumber the statute books and are never enforced. Public opinions, like revolutions of nature, are of slow growth and of steady movement, but like the progress of a glacier adown its eroded valley, are as irresistible as fate, and it would seem the wise course to mould public opinion gradually to the groove it needs to follow in, rather than by any too radical haste defeat the purpose for which wise laws are framed.—*Oil and Drug News.*

REVIEWS.

Commercial Organic Analysis, Vol. II.

By Alfred H. Allen, F.I.C., F.C.S. London: J. & A. Churchill.

We note with pleasure the completion of the second, and, as at present advised, the concluding volume of this excellent work, which not only fills a vacuum so often felt in the libraries of analysts, but also occupies the space in a thoroughly systematic manner. In the preface to the present edition, the author says: "I have been reluctantly compelled to omit several important sections which it was my original intention to include," and under essential oils, drugs, resins, &c., there are expressions to the effect that as these articles only specially interest a few druggists any scheme for their analysis is omitted, but the reader is referred to certain authorities which are duly named as treating on the subject. Mr. Allen was wise not to load his work with such special information, and to stick to the great commercial products which are continually passing through the hands of an analyst in general practice.

The present volume, commencing with the hydrocarbons, takes us through oils and fats to sugar and allied bodies, and finally winds up with alkaloids and the aniline bases. Under the hydrocarbons we meet with careful and excellent directions for fractional distillation now greatly simplified by the use of the bulb apparatus therein described, and an account of the separation and estimation of the various paraffins. We then meet with a very carefully written portion devoted to the constitution and analysis of coal tar distillates, especially the benzols and anthracene. The mysteries of 90 and 50/90 benzols are fully elucidated, and the "contract" method of testing fully described. Very proper stress is also laid upon the great reduction in the value of a benzol which is caused by the presence of light hydrocarbons so common in the Scotch and Cannel products, and due directions

are given for their estimation. The best methods of examining commercial oil of mirbane and anthracene are also given—the latter in special detail. There is much original matter in this chapter.

The section on oils and fats is very complete, and the analytical matter is brought down to the latest date. The enormous number of old empirical tests for the various oils are, to a great extent, passed over, and only those which have stood the test of use by modern observers are retained. The analysis of fatty oils for mineral oils by Mr. Allen's own process, whereby shaking the soap solution with ether is adopted, instead of the more cumbrous extraction of the dry soap with petroleum spirit, and Koettstorfer's most useful alkaline saturation method for aiding in the distinguishment of oils and fats, and Muter's improved method for oleic determination, are all in their proper places. The systematic method for qualitative detection is Muter's modification of Chateau's scheme, which is all placed by the author in one table, an arrangement conducing to simplify its use. In such an extensive subject as fats, of course it is not to be expected that every point can come under the notice of one man, and therefore it is not astonishing perhaps, that, while the old adulteration of lard by water is discussed, and is stated to be the only common one, no mention being made of the far more frequently met with modern artificial "lard-olein," now so extensively used as an adulterant, although its existence is perhaps only known to a few specialists in fat analysis. It is evident that in writing this section of the work, the author has given much time to the actual practical proving of the processes employed, and this being so, it makes it the more remarkable that, in estimating water in lard, butter, palm-oil, and other kindred fats, he should adopt the old slow method of heating them in an air-bath till the moisture is expelled, instead of the more rapid and convenient one of placing the fat in a small tared porcelain dish, heating it over a low gas-flame, and stirring with a thermometer till the frothing ceases.

Under the head of soap, the author gives the fullest directions, not forgetting the very essential modifications in the process necessary in dealing with Ceylon soap, or that made from palm-nut oil, both of which contain soluble acids. But here again an omission is made in our opinion by no notice being taken of the process for estimating rosin in soap, which depends on the formation of perfectly dry neutral sodium soap, and the percolation of the same with a mixture of ether and absolute alcohol in proper proportions, which is a method always giving good results in our hands.

The next section of the work deals with sugar and allied bodies, and some excellent formulæ are given for the analysis of the modern brewing glucose by the combined use of solution-density, Fehling's solution, and the polariscope, whereby the respective amounts of glucose, maltose, and dextrin, are simply and readily obtained. Under the head of cellulose, the microscopic characters of the various commercial fibres are shortly discussed.

In the final section of the book, we meet with the alkaloids, including a *resumé* of the best methods for the assay of cinchona bark and opium, and excellent directions for the detection of the various poisonous alkaloids in toxocological cases. Finally, we meet with aniline, and its derivatives, and have directions for the assay of aniline oils, and the identification and assay of the more common dyes derived from them. This is, however, but shortly touched upon, and other dye stuffs are altogether omitted, the author stating in his preface that he considers this subject to have been so adequately treated in Calvert's and other allied works, as not to require repetition in the present book.

In conclusion, we have simply to say that we sincerely recommend Mr. Allen's work to our readers, as one evincing great care in compilation and more originality than is usually met with in books on analysis. In a word, no modern analyst's library can be considered complete without a copy.

A Manual of Sugar Analysis.

By J. H. Tucker, Ph.D. New York: D. Van Nostrand. London: Sampson, Low & Co.

From America comes the first attempt to write a work in the English language entirely devoted to this interesting and commercially important subject, and we may at once admit that our American cousin has done his work thoroughly well. The book is divided into eighteen chapters of which the first four are devoted to the theoretical chemistry of the substances afterwards treated. The fifth chapter gives directions for taking the specific gravity of saccharine liquids by every known method; while the sixth is specially interesting. In it we have a full account of the theory and practice of saccharimetry by the polariscope and illustrated descriptions of every known instrument, the author preferring evidently the "shadow" class, and especially favouring Dubosq's and Laurent's system, especially the latter, for which he claims the important advantage of its working with coloured solutions. Then follows a minute consideration of the various systems of decolorizing a solution before using the polariscope which is copiously illustrated by experiments, showing the possible error with each of the commonly used agents such as basic acetate of lead and animal charcoal. After a short chapter on the purely chemical methods of estimating sucrose, we arrive at the estimation of glucose with Fehling. Here the author is again very minute, pointing out sources of possible error, and then follow in due order special chapters on the analysis of raw rugar, molasses, cane juice, beet juice, waste products, commercial glucose, milk sugar, diabetic urine, and animal charcoal. We will not follow the author into the discussion on the method of reporting results and making allowances, and the relative merits of the French and other systems suffice it to say that we do not go altogether with him on some of these disputed points. Taken as a whole, however, the book is an excellent one, and supplies a most decided want on the part of a large number of analysts and sugar refiners, and we have no doubt of its success.

SKIMMED MILK IN NEW YORK.

A Test Case Decided in the Court of General Sessions, New York:—

A case of more than usual interest to milk-dealers and consumers was brought to a conclusion in the General Sessions Court, New York, on January 11th. It was brought for the purpose of testing the power of the Board of Health to prevent the sale of skimmed milk in this city. The defendant was Thomas R. Gray, a milk-dealer, doing business at No. 79, East Broadway. He was defended by Messrs. Spencer and Dunning, and counsel for the Board of Health conducted the prosecution. The evidence showed that on September 27th, J. W. Taintor, a member of the firm of Woodhull & Co., dairymen, at Monroe, N. Y., shipped to Gray 10 sealed cans of milk from which the cream had been skimmed. After the milk reached the city a messenger was sent to the Board of Health with the information that Gray was selling skimmed milk. Gray, as alleged, advertised such milk for sale, and displayed a large placard in front of his store containing the same announcement. Dr. J. Blake White, an Inspector of the Health Board, promptly visited Gray's store with a number of assistants and seized the milk, which they found on sale at 3 cents per quart. On Dec. 15th, Gray was indicted for selling adulterated milk.

and held in 250 dols. to await the result of a trial. The Board of Health based the prosecution of Gray on the ground that skimmed milk was not a wholesome article of human food, and that its sale was a violation of law. The defence, on the other hand, contended that such milk, unmixed with water or any other substance, was a wholesome article of food, and consequently did not come under the head of "adulteration." The ordinance prohibiting its sale they held to be unconstitutional. In support of their argument, the defence examined a number of experts, the most prominent of whom was Prof. R. Ogden Doremus, who testified that milk from which the cream had been removed, unadulterated by any other substance, was not unwholesome. He admitted, however, that for infants or invalids who could take no other nourishment it was probably not as wholesome as milk from which the cream had not been skimmed.

In charging the jury Recorder Smyth said he should uphold the constitutionality of the law from which the Board of Health derived its authority. In view of the great importance of the case, he would require the jury to hand in a special verdict in writing, consisting of answers to four questions propounded by the court. The jury then retired, and after a short deliberation announced that they had come to an agreement. The questions and answers comprising the special verdict were then read by Chief Clerk Sparks, and were as follows:—

First.—Did the defendant, on the 27th day of September, 1881, at the County and City of New York, expose for sale at his store, No. 77, East Broadway, in this City and County, impure, adulterated, and unwholesome milk? The jury found, as matter of fact, that he did.

Second.—Did the defendant on that day keep, have, or offer for sale milk which had been watered, adulterated, reduced, or changed in any respect by the addition of water or other substance, or by the removal of cream? The jury found that he did.

Third.—Was the milk kept, had, or offered for sale by the defendant watered or adulterated, reduced or changed in any respect other than by the removal of the cream therefrom? The jury found that it was not.

Fourth.—Is milk which has been reduced by the removal of the cream therefrom impure and unwholesome as an article of human food or injurious to health? The jury found that it was both injurious and unwholesome.

The answers to the questions were subscribed to by every member of the jury. The Recorder postponed judgment in order to give counsel for Gray an opportunity to argue for a new trial. The decision of the jury is looked upon as one of great importance, and it is a practical indorsement of the declaration of the Board of Health that the sale of skimmed milk is a violation of law.—*New York Times.*

⁂ With reference to the above case, we are informed that the considerations urged were that skim milk administered as whole milk to children and invalids is unwholesome, and on that ground such a decision was rendered. The U.S. local Boards of Health are empowered to pass certain ordinances which shall protect the public health, the violation of which by law constitutes a misdemeanour of a certain grade. The prosecution was brought under one of those ordinances prohibiting skim milk from being held for sale in New York city, and the law enacted by the N.Y. State legislature last summer, also practically does the same thing, and one of the counts was under that law. The reason for such action is that milk supplied, for instance, in the morning to customers, might be in cans plainly marked "skim milk" without the actual purchaser really seeing them and knowing that he was being supplied with skim milk. Also the cans might be placed behind a counter, or as in the above case in ice tubs so that the mark on the cans of "skim milk" might be concealed from the purchaser. To permit the sale of skim milk from cans even when conspicuously marked as containing it seemed to open the door to too much possible fraud, and its sale therefore has been prohibited. In this case they proposed to test the constitutionality of such action on the part of the Health Board and of the Legislature. The sample of milk in question contained the extraordinarily small amount of 0·079 per cent. of butter fat, and about 9·4 or a little over of solids not fat.—Ed. Analyst.

The Local Government Board have sent a letter to the Dorchester Town Council inquiring why during last year no samples were submitted to the Borough Analyst. At the meeting of the Council recently it was decided to reply that the reason was because there were no samples to submit.

THE PUBLIC WATER SUPPLIES OF ENGLAND.

VALUATION, ACCORDING TO "WIGNER'S VALUATION SCALE," OF THE VARIOUS WATER SUPPLIES.

	Average for 1881.	January 1882.	Feb. 1882.
London—			
Kent	29·5	36·5	34·0
New River	24·7	35 0	24·0
East London	33·2	40·0	64·0
Southwark and Vauxhall	34·3	44·0	35·0
West Middlesex	33·0	40·0	29·0
Grand Junction	30·3	41·0	29·0
Lambeth	35·7	40·0	36·0
Chelsea	34·0	48·0	31·0
Bath	12·0		
Birmingham	34·6	36·0	33·0
Bolton	22·7	27 0	26·0
Bradford	48·3		
Brighton	23·9	27·0	32·0
Bristol	25·1	25·0	26·0
Bury	29·5	36·0	
Cambridge	25·3	23·0	24·0
Canterbury	16·0	15·0	20·0
Coventry	32 5		
Croydon	23·1	24·0	24·0
Darlington	54·2	57·0	100·0
Derby	17·6		
Doncaster	35·0		
Droitwich	39·0		
Dublin	18·5	16·0	42·0
Dudley	45·0		
Edinburgh	25·9	21·0	39·0
Exeter	20·2	20·0	18·0
Grantham	32·9	31·0	27·0
Guildford			29·0
Hastings	26·2		22·0
Huddersfield	24·3		
Hull	22·7		
Huntingdon			37·0
Ipswich	27·7	29·0	27·0
King's Lynn	96·6	103·0	80·0
Leamington	25·5		28·0

	Average for 1881.	January 1882.	Feb. 1882.
Leeds	32·8		
Leicester	33·1		34·0
Liverpool	36·3	48·0	27·0
Llandrindod	13·0		
Maidstone—			
Water Company	30·5	31·0	37·0
" Public Conduit	26·3	27·0	30·0
Manchester	25·7	30·0	27·0
Newark	38·4	30·0	29·0
Newcastle-on-Tyne	43·6	41·0	33·0
Northampton	39·5		
Norwich	36·6	32·0	35·0
Nottingham	45·6	35·0	37·0
Oldham	23·6		
Plymouth	28·7		
Pontefract	171·0		
Portsmouth	27·4	25·0	26·0
Reading	25·8	31·0	29·0
Rochdale	8·4	8·0	11·0
Rotherham	18·9		
Rugby	47·0	45·0	68·0
Salford	19 9	15·0	22·0
Sevenoaks	19·9		
Sheffield	21·4		
Shrewsbury	22·6		25·0
Southampton	42·6	44·0	36·0
Stockport	17·4		
Stourbridge	37·3		
Stourport	27·0		
Sunderland	25·0		
Swansea	15·1	16·0	12·0
Tunbridge Wells	35·0		
Warwick	36·1	27·0	
Whitehaven	10·0	7·0	13·0
Wolverhampton	38·7		
Worcester	54·9		

We give above a list of all the towns whose water supplies have been examined and reported upon during the last year, together with the average valuation of the impurities in each supply for the year. We also give the usual valuation of the month's supplies. We are compelled to defer making any remarks on these valuations until our next number.

At a recent meeting of the Middlesex Magistrates, Mr. A. G. Crowder moved:—"That the inspectors under the Sale of Food and Drugs Act, 1875, be instructed to make a practice of submitting for analysis, each quarter, samples of intoxicants of all kinds, also a larger number of samples of food and drugs than heretofore." He said the Act had been in force about six years, and was intended to have a general application to all food and drugs; but he had observed that in the matters referred for analysis, a large proportion were as to the purity of samples of milk, while no mention whatever was made of whisky or other intoxicants chiefly in use amongst the poorer classes, and he thought there ought not to be only an analysis of these intoxicants, but also of ale and porter. Sir W. H. Wyatt said as the analysis of each sample cost a guinea, if there were an increased number it would entail a serious expense, and he thought this was a subject that should be referred to the Committee of Accounts and General Purposes Committee for consideration, and he moved an amendment to that effect. The Chairman put the motion, and the amendment was carried.

SOCIETY OF PUBLIC ANALYSTS.

Analyses of English Public Water Supplies in February, 1882. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Date when drawn.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine in Chlorides.	Phosphoric Acid in Phosphates.	Nitrogen in Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in: 15 mins. at 80° Fahr.	Oxygen, Absorbed in: 4 hours at 80° Fahr.	Hardness, Clark's Scale, in degrees: Before Boiling.	Hardness, Clark's Scale, in degrees: After Boiling.	Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
Kent Co.	Feb. 23	c. yellow blue	none	2·05	none	·83	·0008	·0032	·004	·012	23·6°	7·0°	32·2	veg. debris	Wigner & Harland.
New River	,, 15	clear	none	1·12	trace	·31	·0021	·0042	·009	·025	15·5°	4·5°	22·4	satisfactory	B. Dyer.
East London	,, 14	yellow blue	slight	1·42	h. trace	·53	·0012	·0163	·036	·048	15·0°	6·0°	22·8	animal., veg. deb., fibres	Wigner & Harland.
Southwark & Vauxhall	,, 24	p. yell. & clear	none	1·24	trace	·14	none	·0040	·039	·074	15·5°	4·5°	21·2	satisfactory	J. Muter.
West Middlesex	,, 20	greenish	none	1·20	trace	·09	·0130	·0044	·021	·037	14·0°	3·0°	21·0	satisfactory	O. Hehner.
Grand Junction	,,	p. yellow tint		1·15	trace	·24	·0057	·0058	·031	·102	15·1°	4·0°	20·9		A. Wynter-Blyth.
Lambeth	,, 24	p. yell. & clear	none	1·49	trace	·15	·0050	·0050	·033	·065	16·0°	4·5°	23·2	satisfactory	J. Muter.
Chelsea	,, 13	c. p. green	none	1·19	trace	·19	·0014	·0042	·003	·086	19·0°	5·0°	23·2		A. Dupré.
Birmingham	Feb. 6	c. yell. green	none	1·47	trace	·23	·0020		·024	·047	8·9°	7·1°	19·6	none	A. Hill.
Brighton	,, 8	yellow blue	none	2·13	none	·38	·0011	·0014	·018	·022	16·0°	5·0°	22·8	animal., veg. deb., fibres	Wigner & Harland.
Bolton	,, 10	s. turbid	none	·42	none	·04	·0024	·0040	·020	·037	3·4°	3·4°	8·1	mineral and veg. debris	W. H. Watson.
Bristol	,, 13	p. brnsh. green	none	·68	trace	·06	·0002	·0035	·020	·041	17·9°	1·8°	22·0	sand and veg. debris	F. W. Stoddart.
Bury (Lan.)	,, 11	s. turbid	s. mossy	·88	none	·04	·0038	·0098	·024	·044	4·7°	4·5°	7·8	mineral and veg. debris	W. H. Watson.
Cambridge	,, 15	c. pale blue	none	1·40	traces	·46	·0030	·0020	·005	·012	·16°	5·5°	25·0	satisfactory	J. West Knights.
Canterbury	,, 21	c. pale blue	none	1·47	none	·33	·0050	·0050	·004	·005	6·6°	3·6°	12·0	s. mineral	S. Harvey.
Croydon	,, 21	brgt. colourless	none	1·12	traces	·09	·0030	·0060	·009	·009	16·0°	4·5°	26·0	satisfactory	C. Heisch.
Darlington	,, 17	c. yellow	s. peaty	·70	traces	none	trace	·0077	·140	·218	5·0°	4·5°	8·1	satisfactory	W. F. K. Stock.
Edinburgh	,, 9	v. s. brown	none	·72	none	trace	·0040	·0016	·096		4·2°	4·0°	5·2	none	J. Falconer King.
Exeter	,, 11	f. brnsh. yellow	none	·91	trace	·15	·0007	·0004	·015	·030	2·9°	2·9°	7·0	none	F. P. Perkins.
Grantham	,, 13	c. p. blue	none	·10	trace	·62	·0011	·0014	·009	·009	15·0°	4·7°	23·0	diatoms	A. Ashby.
Guildford	,, 10	f. grnsh. yell.	none	1·09	trace	·17	·0043	·0042	·021	·028	15·5°	6·7°	23·8	satisfactory	A. Angell.
Hastings	,, 20	c. blue	none	4·50	trace	·03	·0021	·0028	·001	·008	6·0°	3·5°	22·1	none	H. F. Cheshire.
Huntingdon	,, 13	c. p. blue	none	1·96	trace	·17	·0015	·0070	·024	·044	18·0°	7·5°	38·5	satisfactory	J. West Knights.
Dublin	Jan. 30	s. yellow	none	·89	trace	trace	·0015	·0045	·056	·196	1·4°	·6°	4·2	satisfactory	C. A. Cameron.
Ipswich	Feb. 18	c. colourless	none	2·35	trace	·82	·0037	·0045	·001	·005	22·0°	3·9°	32·8	satisfactory	J. Napier.
King's Lynn	,, 7	drty. mlky. wht.	earthy	1·62	trace	·28	·0018	·0056	·182	·266	16·5°	5·5°	24·6	veg. debris, diatoms, &c.	W. Johnstone.

Analyses of English Public Water Supplies in February, 1882. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Date when drawn.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine in Chlorides.	Phosphoric Acid in Phosphates.	Nitrogen in Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in: 15 mins. at 80° Fahr.	Oxygen, Absorbed in: 4 hours at 80° Fahr.	Hardness, Clark's Scale, in degrees: Before Boiling.	Hardness, Clark's Scale, in degrees: After Boiling.	Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
Leamington ..	Feb. 16	c. greenish	none	1·54	none	none	·0021	·0028	none	none	24·8°	11·9°	25·9	none	A. Bostock Hill.
Leicester......	,, 20	v. s. yellow	none	1·55	trace	·08	·0013	·0062	·027	·091	8·7°	5·5°	14·4	satisfactory	W. M. Emmerson.
Liverpool	,, 17	yellow green	s. peaty	1·02	trace	·04	·0014	·0070	·110	·063	4·8°	3·7°	7·2		A. Smetham.
Maidstone—															
Wtr. Company	,, 15	p. green s. turb.	none	2·93	trace	·57		·0021	·018	·024	21·3°	8·6°	38·0	none	M. A. Adams.
Public Conduit	,, 15	c. p. blue	none	2·71	trace	·72		·0007	·003	·018	20·0°	7·7°	31·6	none	M. A. Adams.
Manchester....	,, 23	s. turb. f. yell.	none	·74	none	none	·0030	·0028	·024	·092	1·8°	1·6°	4·7	s. mineral	W. Thomson.
Newark	,, 11	c. p. green	none	1·12	trace	·05	·0019	·0037	·015	·036	17·0°	12·5°	33·7	satisfactory	A. Ashby.
Newcastle-on-Tyne......	,, 8	f. yellow	none	·91	trace	·04	·0010	·0080	·051	·091	16·4°	5·9°	21·2	satisfactory	J. Pattinson.
Norwich	,, 13	p. grnsh. yellow	none	1·75	trace	·04	trace	·0044	·036	·047	14·0°	3·7°	16·5	satisfactory	W. G. Crook.
Nottingham ..	,, 16	c. p. blue	none	1·56	none	1·24	·0007	·0064	·004	·004	16·0°	5·0°	21·6	veg. deb., sand, anl. fibres	Wigner & Harland.
Portsmouth ..	,, 4	v. s. turbid	none	1·26	trace	·18	trace	·0042	none	none	13·4°	2·0°	18·5	decomp. veg. deb. diatoms	W. J. Sykes.
Reading	,, 9	c. f. green	none	1·95	none	·12	·0007	·0049	·023	·085	14·6°	4·0°	18·9	satisfactory	J. Shea.
Rochdale	,, 19	greenish	none	·65	none	·01	·0038	·0040	·001	·004	4·0°	2·8°	5·6	satisfactory	T. A. Collinge.
Rugby	,, 10	v. f. turbid	none	1·21	trace	·30	·0105	·0168	·019	·100	10·0°	9·0°	16·8	veg. deb., sand, diatoms	A. P. Smith.
Salford	,, 8	c. yellow	none	·60	none	none	·0028	·0035	·017	·112	3·0°	2·5°	6·0	none	J. Carter Bell.
Shrewsbury ..	,, 18	c. colourless	none	1·45	trace	·33	·0025	·0060	none	·004	22·0°	6·0°	25·0	none	T. P. Blunt.
Southampton..	,, 14	grnsh. yellow	none	·98	h. traces	·17	·0036	·0086	·011	·080	12·6°	5·0°	20·0	satisfactory	A. Angell.
Swansea	,, 17	clear	none	·90	trace	none	·0007	·0056	·003	·004	1·4°	1·4°	3·6	none	W. Morgan.
Whitehaven ..	,, 10	c. f. green	none	·39	none	·01	none	·0014	·007	·022	·4°	·4°	2·2	veg. deb., diatoms	A. Kitchin.

Abbreviations:—c., clear; f., faint; h., heavy; p., pale; v. h., very heavy; v. s., very slight.

A UNIVERSAL FLUX FOR SILVER ASSAYS.

George L. Stone, 1879, gives us a universal flux for the assay of basic silver ores. Its composition is as follows—

Soda	9 parts.
Borax Glass	3 „
Argol	1 part.

Mix thoroughly and keep on hand ready for use. For one third assay ton of ore, fill the crucible about two-thirds full of the flux, adding two or three iron nails when the ore contains much sulphur.—*Columbia College School of Mines Quarterly.*

The Testing of Oil of Bitter Almonds.—This substance is frequently adulterated with artificial oil of bitter almonds (essence of mirbane or nitro-benzol). This adulteration is best detected by the reaction by which it yields aniline under the influence of nascent hydrogen, which the genuine oil does not. The test is applied in the following manner: To an alcoholic solution of the oil some fragments of granulated zinc are added, and then about half its volume of strong hydrochloric acid, after which the solution is gently warmed. An energetic reaction ensues, which should be allowed to proceed for about five minutes. The liquid which now contains, if nitro-benzol was present, chloride of aniline is poured off from any undissolved zinc and treated with an excess of strong solution of caustic potash until the precipitate at first formed is redissolved. The aniline thus set free is extracted from the liquid by agitation with ether, the ethereal layer is removed, placed in a test-tube with an equal bulk of water and a few drops of a cold solution of bleaching powder added, when a splendid mauve coloration will be produced, the intensity of which depends upon the amount of nitro-benzol, originally present in the sample under examination. Boyveau gives the following as the characters of the genuine oil: The specific gravity varies from 1·043 to 1·060, while some specimens of the spurious oils had a specific gravity of 1·019 to 1·030. The genuine oil, if mixed with an equal volume of sulphuric acid, turns red but remains limpid and clear. The spurious oil, on the other hand, turns dark red in color and then becomes brown, at the same time becoming dull and thick, and finally congealing to a brownish mass.—*Sanitary Engineer of New York.*

ANALYSTS' REPORTS.

At a recent meeting of the Bristol Town Council, the report of Mr. F. W. Stoddart, Public Analyst, was presented. He stated that he had examined seventy-six samples, comprising a considerable variety of articles, and had found eleven adulterated. Some of the results of analysis were as follows:—One sample of mustard was adulterated with 40 per cent. of starch, turmeric, &c.; four samples of mustard were genuine; four samples of coffee were genuine; three samples of pepper were genuine; three samples of arrowroot were genuine; two samples of butter were genuine; two samples of sugar were genuine; one sample of castor oil was genuine.

At the quarterly meeting of the Neath Town Council the Borough Analyst reported that during the quarter he had analysed a sample of coffee which was a mixture of 60 per cent. of coffee and 40 per cent. of chicory; a sample of mustard adulterated with a mixture of 25 per cent.; and a sample of pepper which was genuine.

Dr. J. F. Hodges, Analyst for Belfast, reports that during the past quarter he examined forty-six articles of food, drink, and drugs, viz., thirty-five samples of sweetmilk, four of aerated water, one of restorative, two of sarsaparilla, one of ginger ale, two of kali water, and one of cream of tartar. Of these seven samples were adulterated or impure, viz., five samples of milk to which water had been added, and two samples of aerated water containing metallic impurities. During the past twelve months 213 articles have been examined by him, as Analyst for the Borough, of which he found 52 samples to be adulterated or impure. Some of the samples of milk sold in Belfast were largely adulterated by the addition of water, and fines, amounting to £35 5s. 6d. were imposed by the magistrates.

LAW REPORTS.

Adulteration of Porter :—

At Downpatrick Quarter Sessions, before Mr. Thomas Lefroy, Q.C., County Court Judge, the case of Anderson appellant, the Holywood Justices respondents, was heard. The appellant is a publican in Holywood, and his appeal was from a decision whereby he was fined £5 for having sold porter which Dr. Cameron, the County Analyst, certified contained 4 per cent. of solids and 5 per cent. of alcohol, whereas it should have contained from 6 to 9 per cent. of solids. Mr. M'Kane, B.L., was engaged for the appellant ; and Mr. H. N. Johnston appeared to support the decision of the Justices. William Dunne, constable at Holywood, proved the purchase of the porter, and the sending of it to Dr. Cameron. He purchased it on the 9th June, and received the certificate from the analyst on the 18th July. He had no instructions to take this sample of porter, and merely took it in the discharge of his duty as inspector under the Food and Drugs Act. Dr. Cameron, Public Analyst, was then sworn, and corroborated the certificate. He said the liquid was of the nature of porter, but not of the usual quality. The porter sent to workhouses, which is generally of a pure quality, contains from 6 to 7 per cent. of solid matters. Cross-examined by Mr. M'Kane : There is no standard for the quality of porter laid down in the Act of Parliament. He gave evidence before a Select Committee of the House of Commons in favour of fixing a standard for drinks. It was afterwards fixed for gin, rum, whisky and brandy, but for nothing else. He would say this porter was not adulterated, as he did not find any deleterious ingredients. He would say that it was of the nature and substance of porter ; but he objected to its quality. John Anderson, the appellant, gave evidence that he bought the cask of porter from which the sample was taken from Mr. Dempsey, and he had been selling his porter for years, and up till the present ; the price for the cask was 7s. for nine gals., and he retailed at 2d. per pint. He sold all this cask, part of it was drunk at the counter, and there was no complaint. The porter has always given satisfaction, and many of the publicans in Holywood were selling it. John O'Halleran, chemical analyst, Inland Revenue, Belfast, was also examined. He said there was no standard of the quality of porter. He had tested porters and ales with lesser solids than in this sample, and would say they were good of their class. This sample had a high alcoholic strength, and the fermentation would proceed further in the month of June than at this season of the year. The figures given would represent a fair sample of porter at the price it was sold at. He knew of beer being retailed in England at 1½d. a quart, and it was a very weak beer, but might at the same time be of sound character. Sugar might be used in brewing or any non-deleterious material. He would say from the description given of the sample that it was of the nature, substance, and quality of porter, and was not adulterated at all. Cross-examined by Mr. Johnson, he said he had not analysed this sample of porter, but he had many other samples in Belfast and in London, principally for drawback on exportation. These beers were strong beers, and his principal attention was given to ascertain their original gravity by which duty was charged. If he got skim milk instead of new milk he would consider it an offence under the Act, but in this instance the case was not a parallel one. James Dempsey, brewer, Belfast, deposed that he believed the statement of appellant that the porter was bought from him. It was of the usual class of porter sold to the trade, and was brewed at a gravity, leaving a small margin of profit. He never heard of any standard laid down by which he was bound, but if any standard was laid down to bind all brewers alike, he would be quite prepared to fall in with it. For thorough analysis, he believed the sample sent by Dr. Cameron was quite too little, as he could not check his operations. He had only got the third of a pint, which he got on the 9th June, and gave a certificate six weeks after. If this small quantity was drawn from a cask some time on usage, and kept in the bottle so long as six weeks, it would be very flat and much thinner than when delivered by him. Brewers looked principally to the original gravity as their standard, and under it he paid the beer duty. In the case of bitter ales the attenuation was carried further than in that of porter, and

no brewer was able to keep his drinks at a standard of gravity while undergoing secondary fermentation, which was the case with all light porters for draught. This secondary fermentation might either leave the porter rich in alcohol or injured by acetic acid, and the formation of either alcohol or acetic acid takes place at the expense of the saccharine or solids, and if the acetic acid had developed in this sample the solids would very much disappear. Dr. Cameron said the sample of porter was sound and free from acidity. This porter appeared to be made with a proportion of sugar, for the reason that it did not contain a fair amount of extract. Porter brewed with sugar would contain a larger amount of alcohol and less of extractive matter than if made from genuine malt. The alcohol in the porter was largely the result of fermentation, and therefore the article was not genuine as people generally understood genuineness in this connection. Mr. Dempsey said Dr. Cameron had been analysing the highest sample of porters, and his certificate in favour of some brewers was largely used in advertising their manufacture. He did not think it necessary to employ Dr. Cameron to analyse his porter, and this probably explains why he was selected for a test case. He said that the proportions of malt used in that brewing were 12 barrels of best malt to 2 cwt. of sugar, and it was customary in all porter breweries to use sugar at the discretion of the brewer. This was probably an exceptional case with him, as he seldom used sugar; but a good beer could be brewed from the materials mentioned. Mr. M'Kane then addressed the Court, replying on the facts that there was no fixed standard defined in the Act of Parliament, and that no adulteration had been practised, that the public taste, as evidenced by its sale, with competition, in Holywood, was proof in favour of its good quality. His Worship said that he did not know it was absolutely necessary to show that there had been adulteration in the old-fashioned sense of the term, which meant that some foreign substance was added. It was a great difficulty in the way that there was no fixed standard; and, under all the circumstances, he did not see any reason to alter the decision of the magistrates below. This case was different from one that could be regulated by a fixed standard. He would, therefore, only allow the ordinary costs of 10s. 6d., and leave the county to pay the rest.

RECENT CHEMICAL PATENTS.

The following specifications have been recently published, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

No. 1881	Name of Patentee.	Title of Patent.	Price.
1716	J. Storer	Obtaining Ammonia	2d.
2747	G. Bischof	Purification of Water	4d.
2838	C. F. Claus	Purification of Coal Gas	4d.
2863	A. M. Clark	Manufacture of Dye Products from Indigo, and Derivatives of Aniline	4d.
3005	J. W. Bottomley & R. Molesworth	Manufacture of Chlorate of Soda	2d.
3049	F. W. Haddan	Electric Lamps	6d.
3072	C. F. Claus	Manufacture of Compositions Containing Pyroxiline or Nitro Callulose	4d.
3076	W. R. Lake	Disinfection or Purification ol Alcohol Obtained from Beetroot or Molasses	4d.
3138	F. Versmann	Treatment of Soap Lyes for Separation of Glycerine ..	2d.

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; Journal of Applied Science; The Provisioner; The Practitioner; New Remedies; Proceedings of the American Chemical Society; Le Practicien; The Inventors' Record; New York Public Health; The Scientific American; Society of Arts Journal; Sanitary Engineer of New York; The Chemists' Journal; Oil and Drug News; Sugar Cane; Country Brewers' Gazette; The Medical Record; Oil and Drug Journal; The Canada Lancet; Gas and Water Engineering; The Grocers' Gazette; Columbia School of Mines Quarterly Magazine.

THE ANALYST.

APRIL, 1882.

SOCIETY OF PUBLIC ANALYSTS.

A General Meeting of this Society was held at Burlington House, on the 15th March. In the absence of the President, the chair was taken by Dr. Muter, Vice-President.

The minutes of the previous meeting were read and confirmed.

The following gentlemen were proposed for election as Members:—Mr. R. Tervet, Clippens Oil Works, Analytical Chemist, and Mr. T. Harrington, Public Analyst for Cork.

The following papers were read and discussed:—

"On Milk Analysis," by Dr. Vieth.

"Some Points in Milk Analysis," by O. Hehner.

The letters received by the President in reply to his circular respecting the proposed adoption by the Society of a Water Valuation Scale were then opened and read. The discussion on the question was then resumed by the Members present, and a division taken on the original motion, made in June last—viz.: "That a Water Valuation Scale, analogous to that which has been suggested, be recommended by the Society for the adoption of its Members"—with the following result:—

	Against.	For.
Letters	17	9
Members present	8	2
	25	11

Two Members were neutral.

The question of the continuance of the publication in The Analyst of the monthly valuations was raised, and after discussion it was resolved: "That the Editors be requested not to publish in The Analyst a valuation for the analyses of those Analysts who send their forms up without them.

The next Meeting of the Society will be held at Burlington House, on Wednesday, April 19th.

ON MILK ANALYSIS.

By Dr. P. Vieth, F.C.S., &c.

Read before the Society of Public Analysts on 15th March, 1882.

At the November meeting of this Society I was requested to bring before the Society my experiences in analysing milk, especially those obtained in my present position as an analyst to the Aylesbury Dairy Company. I understand perfectly well that it will be of greater importance to you to hear some figures obtained in my laboratory here than those obtained elsewhere, still I think it will not be without interest to you if I tell you in the first place about the method practised and the results of milk analysis arrived at in other places, even in another country—in Germany.

There has been a great deal done in milk analysis in Germany lately, but whilst nearly all the milk analyses carried out and published in England are done by Public

Analysts for the purpose of controlling the milk sold to the public, in Germany the said analyses are done for the greater part with regard to dairying, and only in some few larger places the government think it necessary to have the milk analysed which is brought into the market. Much attention has been paid to dairy farming in all parts of Germany since the last ten or twelve years, and as the experimental stations for agriculture, of which there is a great number in Germany, have done a great deal of good, it has been thought desirable, even if not necessary, to establish such stations especially for dairy purposes. These dairy experimental stations were established to support practical dairying by scientific researches. The first of those stations is that of Raden in Mecklenburg, established in the year 1876, and presided over by Professor Dr. Fleischmann, together with whom I had the honour to work for four years. There are two other dairy experimental stations at Kiel and at Proskau, under the direction respectively of Dr. Schrodt and Dr. Schmoeger, both very skilful analysts. As all the work done at those dairy stations relates exclusively to scientific experiments and researches, as further those analysts work quite independently, and—last, not least—as they are thoroughly educated for their work, I have reason to believe that the results of milk analyses published by them are quite correct.

The method adopted for analysing milk is the following. To ascertain the water, about 5 grammes of milk are placed in a weighed dish—generally very thin glass dishes are used—containing some sea sand, heated strongly before use, and heated in an air-bath at a temperature of 100° to 105° C, until the dish does not lose any more in weight, that is to say, until two weighings do not differ by more than one millegramme. The increase of weight of the dish with sand gives the total solids, the decrease of weight of the dish with sand and milk the amount of water. To ascertain the fat, about 10 grammes are dried up with sea sand, glass powder, or plaster of Paris. The dry powder is put into a case of filter paper covered with cotton wool and extracted in Soxhlet's extraction apparatus, with quite pure dry ether. After one hour the extraction is generally finished, the ether is then distilled, and the fat remaining dried and weighed. To ascertain casein, albumen and sugar, about 10 grammes of milk are diluted in a beaker with 200 c.c. of water and acetic acid added to precipitate the casein. Care must be taken to avoid an excess of acid. The casein is collected on a weighed filter, washed, dried and weighed. The filtered fluid is boiled and somewhat concentrated, thus coagulating the albumen, which is collected on a weighed filter. In the filtrate then the milk sugar is ascertained by titration with Fehling's solution or by polarisation. The nitrogenous matters—casein and albumen—may be ascertained by combustion of the solids of a weighed portion of milk with soda-lime, and multiplication of the percentage of nitrogen with 6·25. To ascertain the ash, about 10 grammes of milk are evaporated in a platinum crucible on the steam-bath, the solids are charred, the coal extracted with boiling water, and burnt to ash. The solution of the soluble salts is put back into the crucible, the water evaporated again on the steam-bath and the residue heated very carefully only to dark red-heat. All the quantities of milk taken for analysis are not measured but weighed. All the examinations are made in duplicate and the mean taken. The two examinations must not differ more than 0·1 per cent.; for the ash a still smaller difference is allowed.

Having made the analyses in this manner I always came very close to 100 in summing up the yielded percentage of the component parts. Generally I found 0·2 to 0·3

per cent. less, in some cases 0·2 per cent. more than 100. The total solids or the water were, as I stated, ascertained by drying at a temperature of 100 to 105° C., that is a temperature at which milk sugar, heated by itself, loses its crystallization water. But the behaviour of milk sugar when heated differs greatly under different circumstances, certainly the changes of its physical properties are not always the same. Dr. Schmoeger, of Proskau, who made a great many investigations regarding this question, wrote to me some months ago—"The behaviour of milk sugar does not agree with my experiences in analysing milk. I never found the total solids less than the sum of the component parts." Dr. Schmoeger found that milk sugar loses all its crystallization water already by evaporating a solution on a briskly boiling water-bath. If the milk solids are heated higher they lose still more in weight. I found a loss of from 0·2 to 0·4 per cent. when I heated the solids of 5 c.c. of milk for two hours at a temperature of 110° to 115° C.; the solids had been obtained by evaporating the milk and keeping it on the steam-bath for three hours and drying in an air-bath of 95° to 100° C. for two hours. I think that this loss is not only owing to the decomposition of the sugar, but also of the fat and protein.

Much attention is paid in Germany to the specific gravity, and you will scarcely find any analysis of milk published on which the specific gravity is not mentioned.

Now I will give you some results of milk analyses—in the first place those I obtained at Raden. There is a herd of about 120 cows at Raden, and an average sample of the whole morning—and one of the evening—milk is analysed at least once a week. During the year 1879 the limits for specific gravity, total solids and fat were the following:—

	Morning Milk.	Evening Milk.
Specific Gravity	1·0308 to 1·0325	1·0311 to 1·0329
Total Solids	11·71 „ 12·76%	11·90 „ 12·84%
Fat	2·88 „ 3·80%	2·87 „ 3·91%

The average was—

Specific Gravity	1·0319	1·0319
Total Solids	12·18%	12·27%
Fat	3·29%	3·32%

For the year 1880 the following figures were obtained—

Limits—	Morning Milk.	Evening Milk.
Specific Gravity	1·0304 to 1·0325	1·0309 to 1·0328
Total Solids	11·21 „ 12·50%	11·29 „ 12·72%
Fat	2·95 „ 3·68%	2·92 „ 3·82%

Average—

Specific Gravity	1·0315	1·0316
Total Solids	11·84%	11·93%
Fat	3·26%	3·27%

The figures for solids not fat are in far the most cases between 8·5 and 9·0, they never rise above 9·0, but fall occasionally below 8·5.

There were some other researches made at Raden regarding the composition of milk yielded by cows of four different breeds, each of them being represented by four cows. Altogether 124 analyses were made for the purpose of those researches. The specific gravity fell only once below 1·029, and rose to 1·0339. The lowest and highest figures for total solids were 10·66 and 13·45 per cent., for fat 2·60 and 4·70 per cent. The average of all analyses was for specific gravity 1·0316, for total solids 11·78, and for fat 3·28 per cent. The amount of solids not fat varies from 8 to 9 per cent., falls even below 8·0, and rises in a very few cases above 9·0.

At the dairy experimental station at Kiel ten cows are kept exclusively for the purpose of making experiments. The milk contained in average—

In the year 1878......	Total Solids	12·43 per cent.......	Fat	3·70 per cent.
" 1879......	"	12·13 "	"	3·42 "
" 1881......	"	11·93 "	"	3.40 "

The solids not fat generally fall between 8·5 and 9·0 per cent.

At Proskau the milk of a herd of Dutch cows is at the disposal of the dairy institute. The cows are milked three times a day. The average composition of the milk was in the year 1879—Total solids 11·61 per cent., fat 3·19 per cent., the solids not fat fluctuating from 8 to 9 per cent.

Looking over all the figures previously mentioned, you will see that the specific gravity does not fluctuate very much, say from 1·029 to 1·034. Regarding the total solids and the fat, we may say that all the milk, with very few exceptions, is to be considered as not at all rich milk. The most striking point, however, will be to you the small amount of solids not fat. The solids not fat are never taken into consideration in Germany, and therefore I had to reckon them out for this paper especially. Now, as I know the value of the figures for solids not fat, I wonder that nobody cares for them there. Two figures account for the amount of solids not fat, namely, those for total solids and for fat. If the former are reduced to the lowest point, the latter raised to the highest, the solids not fat will be found proportionately low. That is the case in the previous analyses, but I repeat that I firmly believe them to be right. Thus much about milk analysis in Germany.

It is now about eighteen months since I first came to England, and not quite as long as that since I began my regular work. The Aylesbury Dairy Company thought it necessary to establish on their premises a laboratory fitted up very completely with all instruments and appliances, and to employ an analyst, so that they might be able to extend the system of controlling the milk, as then carried on, to the largest scale, and give their customers the greatest possible security of a regular supply of good, pure milk. Setting aside the two to three hundred examinations by means of the lactometer, to take the specific gravity, there are forty to sixty milk samples analysed daily to secure the object mentioned. Having this work before me, I had to think of three points—firstly, how to manage it; secondly, how to get the most correct results; and thirdly, how to come as close as possible to the method of analysing milk generally adopted by Public Analysts. The first thing was, that I had to abstain from weighing the portions taken for analysis. I measure them by means of correct pipettes. Further, I evaporate the milk taken for ascertaining the total solids in platinum dishes without any addition, and lastly, I do not extract the fat in such a way that I have to use the balance, but ascertain it by means of Marchand's lactobutyrometer. I perfectly know that I cannot claim for analyses carried out in this manner the fullest exactitude, but what they lose of correctness on the one side, they certainly gain by their vast number on the other.

Regarding the total solids, I carried out a series of experiments to decide whether there is any remarkable difference by evaporating milk with or without sea sand. In all cases I placed 5 c.c. of milk in platinum dishes, and kept the same for three hours on a boiling water-bath, and for two hours in the air-bath at a temperature of 95 to 100° C. When weighed, the platinum dishes containing sea sand generally yielded a little less total solids, but the difference was only a very small one, and never exceeded 0·1 per cent.

Regarding the fat, of course I had to abstain from extracting it after Soxhlet's method, which I consider the very best and exactest one we have. I had to employ a simple method, taking as little time as possible, and I never was doubtful what method I would have to choose. As I had made testing milk my special study, I always looked out for instruments and methods proposed for this purpose, and found opportunity to examine most of them myself. On the basis of my own experiences, and of those obtained by other analysts, I must say that of all the instruments proposed for ascertaining fat in milk, Marchand's lactobutyrometer is by far the best one. I expressed that in a book I wrote three years ago, *On the Methods of Testing Milk*, and notwithstanding some new methods having been brought out during the last years, the opinion about the lactobutyrometer has not been changed, as you may see in a book just published entitled *Communications of the Board of Health of the German Empire*. You will find there the same opinion about the lactobutyrometer.

The way to work the lactobutyrometer is a very simple one. 10 c.c. of milk are measured and placed in the tube; 10 c.c. of ether and some few drops of a solution of potassium hydrate are added, the tube then closed and shaken, so that all is well mixed. Then 10 c.c. of alcohol are added, and the closed tube shaken again. After this the tube is placed in water of about 40° C., until all the fat has risen. Then it may be placed in water of about 20° C., and the extension of the fat layer on the top read off. By the aid of a table you will find to how much fat it is equal. The whole operation is finished in about twenty minutes, but even a boy is able to carry out twenty to twenty-five examinations during one hour.

When I tried the lactobutyrometer against Soxhlet's method, I generally found 0·1 to 0·2 per cent. of fat less. I do not want to harass you with figures, and therefore I only give you some few results of ascertaining fat in milk by the said two methods obtained in my laboratory here. The first figure always refers to Soxhlet's, and the second one to Marchand's method:—3·63 and 3·4, 1·98 and 2·0, 3·16 and 3·0, 3·31 and 3·2, 4·06 and 3·8, 4·23 and 4·0, 3·13 and 3·0, 2·82 and 2·6, 2·90 and 2·8, 2·73 and 2·7, 3·54 and 3·4, 3·73 and 3·4, 3·26 and 3·2, 4·30 and 4·2. I call those results very satisfactory, and am sure you will arrive so close to the truth as the previous figures tell you; that is to say, you will not find a larger difference against Soxhlet's method, whenever you work the apparatus in the right manner, and use pure washed ether and pure alcohol of the right strength, namely, of 90 to 91 per cent. The strength of the alcohol is of very great importance. In my laboratory very much less satisfactory results were obtained when alcohol was accidentally used which was stronger than expected and forgotten to be diluted.

The lactobutyrometer is now very well known in Germany, both in laboratories and in dairies and large milk shops. It does not seem to be the same in this country. I by no means think that every analyst ought to buy any new instrument brought out, but I do think one might be allowed to expect some interest in new apparatus, especially when they are brought directly before the eyes of the chemical world. I regret to say that such an interest is not everywhere to be found, otherwise events like the following would be impossible. There was a query in the number of the *English Mechanic and World of Science* issued January 20th:—"To Mr. Allen or any correspondent. Would you kindly tell me what the lactobutyrometer is that is made by the Aylesbury Dairy Company, and

how it is worked? It seems very complicated in the drawings that they publish with their advertisements. I should have thought the quickest method of getting at the fat was that employed in milk analysis. Signed, Aconite." In the number of the same paper issued February 10th, a reply to this query was published as follows:—"I have not seen the advertisement of the Aylesbury Dairy Company referred to by 'Aconite' in his query addressed to Mr. Allen or any correspondent, but presume the instrument in question is one for ascertaining the quantity of fat in milk by estimating the extent of the opacity produced by the suspended fat globules. There are many sources of error in such a method, but it would probably give useful results in certain cases, and certainly would be much more rapid than any process based on the extraction of the fat. Signed, A. H. Allen." I may mention that an advertisement with drawing of the lactobutyrometer was published on the front page of the December and January numbers of The Analyst, the journal of this Society, so that everybody who took The Analyst in his hand must have seen it. But it is not that what I should like to point out. I want to protest very strongly against mixing up an instrument—which, in my opinion, is of the greatest value for ascertaining the fat in milk in all the cases where it is impossible to make an exact analysis—with the so-called lactoscopes, instruments which are, if of any value—only of a very little one, as the principle on which they are based is wrong. I do not want you to understand that I think the results obtained by using the lactobutyrometer irreversibly right. I myself extract the fat by means of Soxhlet's apparatus in all the cases of any importance. But I certainly think the lactobutyrometer a very valuable instrument for judging a milk, especially if you have two other figures besides those for the specific gravity and the total solids. At the last meeting it was mentioned that there is a possibility to account the specific gravity of a milk by addition of the figures for solids, fat, and water. I suppose that was an error, at least I do not know anything of this kind. Certainly there exist some relations between specific gravity, solids, and fat, and by a series of researches carried out by Dr. Behrend and Dr. Morgen, it seems to be possible to find the amount of total solids of a milk, if the specific gravity and the amount of fat is known, and a table, worked out for that purpose by the said analysts, is used. In most of the cases I checked this table, I found that it answers very well, and I hope one day I shall find time to go thoroughly into this matter, as I think it quite worth while. If the table is right, I should think it still of greater value to ascertain the specific gravity and the total solids, and account the fat. I must not omit to state that the lactobutyrometer cannot be used for ascertaining fat in skim milk, as the instrument does not indicate any fat if there is only 1·2 per cent. or less.

I mentioned previously that there are about forty to sixty analyses made in my laboratory daily; a great deal of this work is done by my assistant. The way in which the work is carried out has been communicated in what precedes, now I will give you some of the figures obtained.

The specific gravity of all the milk samples brought into the laboratory—about 250 daily—was generally found between 1·030 and 1·033; in some few cases it fell down to 1·029, and in some other it rose to 1·034. The average specific gravity of the milk examined during the past year, 1881, was 1·0315. The amount of total solids is in far the most cases 12 to 13 per cent., as lowest figure 11·3, as highest 15·7, was noticed; the

yearly average was 12·8 per cent. Fat was generally found to amount 3·0 to 3·5 per cent., the lowest and highest figures being 2·4 and 5·3, the average 3·1 per cent. The last figure, however, is to be considered too low, as there are some wrong figures among them, owing to the use of a too strong alcohol on working the lactobutyrometer. Of course, the figures for solids not fat are affected thereby as well. Generally the amount of solids not fat is between 9 and 10 per cent., the lowest figure noticed was 8·5, the highest 10·6, the average 9·7 per cent. The last figure has to be diminished to the same extent as the average figure for fat is to be raised.

I am fully aware that those figures just communicated to you cannot be compared directly with figures obtained by Public Analysts, as the methods of analysing differ. But I should like to put before you the question—Are milk analyses carried out in the same manner by all the Public Analysts, or by all the members of this Society, or even by all the members here present? I do not think they are. There are, as far as I know, some differences in ascertaining the total solids regarding time and temperature. There are—and on this point I am quite sure—some differences in extracting the fat. One analyst employs Soxhlet's apparatus, a second one extracts the fat by pouring cold ether over the total solids repeatedly, whilst a third one prefers the extraction with boiling ether. No wonder, when the results of analysing samples of the same milk by different analysts differ so much, and give a favourable opportunity to daily papers to speak about untrustworthiness of chemical science. I saw myself the analyses of samples of the same milk made by two Public Analysts, showing the following considerable differences:—

Milk I.	Analyst 1.	Total Solids,	13·5%;	Fat,	4·1%;	Solids not fat,	9·4%.
"	" 2.	"	12·9%;	"	3·2%;	"	9·7%.
Milk II.	" 1.	"	13·5%;	"	3·9%;	"	9·6%.
"	" 2.	"	12·9%;	"	3·2%;	"	9·7%.
Milk III.	" 1.	"	13·1%;	"	4·1%;	"	9·0%.
"	" 2.	"	13·5%;	"	3·2%;	"	10·3%.

Those figures speak for themselves.

Two reasons may account for the fact that some Public Analysts deviate from the method of analysing milk adopted by this Society—namely, the bringing out a more convenient or a more correct method. I should object to a certain degree to the first reason, but cannot object to the second one. Thus when you would find that the extraction of fat is more correct by using Soxhlet's method, I should advise you to adopt this method generally, even then, when you would find that the figures for solids not fat would fall occasionally below your present standard. After all, what I have seen in the time since I have been in England, I believe that the milk yielded here is in general a great deal better than that yielded in the north and middle of Germany. But I also believe that 9 per cent. as standard for solids not fat is too high. To support my assumption, I give you in the following some few figures chosen without selection out of a great number of similar ones—

	1	2	3	4	5	6
Specific Gravity....	1·0305	1·0300	1·0305	1·0300	1·0300	1·0300
Total Solids........	13·02%	12·60%	12·44%	12·64%	12·24%	12·38%
Fat	4·20%	3·80%	3·60%	3·80%	3·40%	3·60%
Solids not Fat......	8·82%	8·80%	8·84%	8·84%	8·84%	8·78%

In all those samples the solids not fat fall below 9 per cent., and in average you would say they contain 2 per cent. of added water. I, however, consider them not only as samples of quite pure but of a very fair milk. Just in the present month, when, with the winter, hay and clover grow towards an end, and the farmers—as it is the same here and

everywhere—do not like to put their hands into their pockets and spend some money for buying food, you will find a great deal of genuine milk with an amount of solids not fat below 9 per cent. I should propose to take 8·5 per cent. as standard for solids not fat. The standard for fat might be raised to 2·75, so that the smallest amount of total solids demanded would be 11·25 per cent.

I should like to touch on yet another question. We all know perfectly well that in some cases it is quite impossible to state that some water had been added to milk. Add 10 per cent. of water to a milk with a specific gravity of 1·033, with 14 per cent. of total solids and 4 per cent. of fat, and you will have a mixture with a specific gravity of 1·030, 12·7 per cent. of total solids, and 3·6 per cent. of fat. By adding 15 per cent. of water the solids not fat would fall below the limit of 9 per cent., they would come down to 8·7 and you would state the milk contains 3 per cent. of added water. I must say that I have always a peculiar impression by reading such a statement. Everybody will know that the profit of an addition of 3 per cent. of water to milk would not cover the risk, and that therefore an adulteration in such an extent will scarcely be executed. I think you could come very easily over this little difficulty if you would not state that so and so much water has been added to the milk, but that the milk falls so and so many per cent. below the standard. By adopting this form for your statements you would be able at the same time to distinguish milk with higher amounts of solids, saying it runs so and so many per cent. above the standard, and such a statement might be of some value now and then.

Before I conclude my paper I should like to call your attention to the great importance of taking the specific gravity of milk to be tested. I ascertained the specific gravity of thousands and thousands of milk samples, but never found it below 1·029 when I had a normal and well mixed milk of at least five cows. There are so many milk analyses published in this country without mentioning the specific gravity, which in many cases would give a very good control of analytical figures. Of course, if a lactometer is employed or taking the specific gravity, one has to examine the instrument, whether it shows the right specific gravity. I have had a great number of lactometers in my hand which differed two, three, and even more degrees. The larger the space for one degree on the scale is, the better it is. Those lactometers are very convenient which are combined with a thermometer, so that specific gravity and temperature may be read off at the same time.

ON SOME POINTS IN MILK ANALYSIS.

By Otto Hehner, F.C.S., F.I.C.

Read before the Society of Public Analysts on 15th March, 1882.

It can hardly be expected that anything very novel can be brought forward in a subject which has been so well ventilated, and which before all others has engaged the attention of Public Analysts, as milk analysis. But from some statements which have recently been made before us (see Mr. W. Johnstone's paper in No. 72 of The Analyst) and elsewhere, it appears that not a few analysts have forgotten, that the results obtained by the analysis of milk are not results laying claim to absolute scientific accuracy, but are only comparative *ones*, and that the limits adopted by the Society—9 per cent. of solids not fat and 2·5 per

cent. of fat—hold good only when each analysis is made in the manner which led to the adoption of these limits; namely, by drying five grammes of the milk for two and a half to three hours over an open water-bath, and by exhausting the residue with from three to six successive quantities of boiling ether. Modifications of this plan have gradually crept in, and concurrently with the adoption of these modifications, instances have multiplied in which undoubtedly genuine milk did fall below the Society's limits. Although it cannot be held that the deficiency in solids not fat was in every case due to the modification in the analytical process, it yet appears certain that in many instances the cause lay less with the milk than with the analyst.

The object of the few experiments laid down in this paper was to ascertain how far the results depended upon the details of the process adopted.

I.—Time and Manner of Drying.

A. 5·2967 grms. of milk were evaporated in a platinum basin, the residue dried on an open water-bath, and weighed every hour.

Weight of residue after 2 hours	·6037	or 11·39	per cent.
3 „	·5971	11·27	
4 „	·5960	11·25	
5 „	·5944	11·22	
6 „	·5941	11·21	

B. 5·0916 grms., treated as above.

Weight of residue after 2 hours	·5764	or 11·32	per cent.
3 „	·5727	11·25	
4 „	·5714	11·22	
5 „	·5702	11·19	
6 „	·5698	11·19	

C. 5·3288 grms. of the same milk were evaporated on a water-bath, and the residue dried in a closed water oven.

Weight of total solids after 2 hours	·6094	or 11·43	per cent.
3 „	·6033	11·32	
4 „	·6006	11·27	
5 „	·5981	11·22	
6 „	·5972	11·20	
7 „	·5958	11·19	

D. 5·3354 grms. dried in a water oven, as in C.

Weight of total solids after 2 hours	·6209	or 11·63	per cent.
3 „	·6091	11·41	
4 „	·6042	11·32	
5 „	·6015	11·27	
6 „	·6001	11·25	
7 „	·5977	11·20	

C and D, weighed after eight hours, showed no further decrease.

E. 5·2980 grms. of the same milk, dried in a water oven.

Weight of total solids after 2 hours	·6132	or 11·57	per cent.
3 „	·6047	11·41	
4 „	·6015	11·35	
5 „	·5965	11·26	
6 „	·5951	11·23	
7 „	·5925	11·18	
8 „	·5919	11·18	

F. 5·0560 grms. of another milk gave, on drying on the open water-bath—

Weight of solids after 3 hours	·5500 or	10·88 per cent.
4 "	·5464	10·80
5 "	·5438	10·75
6 "	·5438	10·75

G. 5·2227 grms. of the same milk, treated like F., gave total solids, after

3 hours	·5655 or	10·83 per cent.
4 "	·5629	10·78
5 "	·5610	10·74
6 "	·5597	10·71
7 "	·5590	10·70

H. 5·3447 grms. of the same milk dried in a water oven.

3 hours	·5818 or	10·88 per cent.
4 "	·5774	10·80
5 "	·5743	10·75
6 "	·5727	10·71
7 "	·5720	10·70

I. 5·1463 grms., treated as H., gave total solids, after

3 hours	·5667 or	11·01 per cent.
4 "	·5590	10·86
5 "	·5546	10·77
6 "	·5525	10·73
7 "	·5519	10·72

It follows from these figures, that milk residues are not really dry after having been heated for three hours, but continue to lose weight until they have been heated from six to eight hours. The results obtained are almost absolutely uniform after drying to constancy, but are by no means so satisfactory after three hours only. Thus, while the greatest difference between the really dry solids was in case of milk I., ·03 per cent.; and in milk II., 0·05 per cent., the percentages differed after three hours ·17 and ·18 from each other. The loss on drying from three hours to constant weight—the weight being taken constant when the loss per hour was less than one milligram—varied from ·06 to ·29 per cent.

It is also seen that milk residues dry somewhat more rapidly on an open water-bath than in a closed water oven.

II.—Temperature of Drying.

The dry residues from A and B were placed side by side into an air-bath, heated to 110° C.

A.	Weight of residue after 1 hour's drying at 110°	·5894 or	11·13 per cent.
	2 " "	·5871	11·09
	3 " "	·5834	11·01
	4 " "	·5817	10·98
	5 " "	·5809	10·97
	6 " "	·5783	10·92
B.	Weight after 1 " "	·5582 or	10·96 per cent.
	2 " "	·5492	10·79
	3 " "	·5480	10·76
	4 " "	·5465	10·73
	5 " "	·5446	10·70
	6 " "	·5440	10·68
F.	Weight after 1 " "	·5390 or	10·66 per cent.
	2 " "	·5363	10·60
	3 " "	·5347	10·57
	4 " "	·5340	10·56

All residues, heated at 110°, become highly rancid, and slightly brown. A had diminished ·29 per cent., B ·51 per cent., and F ·19 per cent., by drying at 110°, after constant weight at 100° had been obtained. It is remarkable that A and B, although heated in the same bath together, yet lost weight very unequally.

III.—Mode of Fat Extraction.

D. The dry residue from D was extracted in a Soxhlet apparatus with absolute ether, and then dried in a water oven to constancy.

Weight of solids not fat after 1 hour's extraction	0·4554 or	8·54 per cent.
2 „ „	0·4521	8·47

The weight did not further diminish by a third treatment of one hour.

C. The dry residue of C. was boiled out with six successive quantities of ether.

Weight of solids not fat .. .. ·4618 or 8·67 per cent.

E. The residue of E. was digested with ether over-night, and next morning boiled out with six lots of ether.

Weight of solids not fat .. .. ·4589 or 8·66 per cent.

After further treatment with six quantities of boiling ether:

Weight of solids not fat .. .. ·4538 or 8·56 per cent.

Residues A and B (dried at 110°) were treated in Soxhlet's apparatus for two hours.

A.—A gave ·4361 grms. or 8·23 per cent. of solids not fat.
B.—B „ ·4101 „ or 8·05 „ „ „

G. The dry solids were boiled out with ether.

3 times. Weight of solids not fat	·4508 or	8·63 per cent.
6 „ „	·4422	8·46
9 „ „	·4420	8·46

H. Extracted in Soxhlet.

1 hour. Solids not fat	·4484 or	8·39 per cent.
2 „ „	·4469	8·36

I. The dry solids were treated with ether over-night, then boiled six times with ether.

Solids not fat .. .. ·4363 or 8·48 per cent.

F. The solids dried at 110° were extracted in Soxhlet for two hours.

Solids not fat .. .. ·4184 or 8·28 per cent.

K. 12,9100 grms. of milk, which yielded by two hours treatment in a Soxhlet extractor 3·12 per cent. of fat, were evaporated on a water-bath with occasional stirring so as to granulate the residue; this was boiled out with six quantities of ether, and the fat determined direct. Obtained ·3509 grms. or 2·72 per cent.

L. The perfectly dry residue from 5 grms. of the milk K. was extracted six times with absolute ether, containing 10 per cent. of absolute alcohol. Fat obtained, 2·98 per cent.

From the results of these fat and solids not fat determinations, it follows that boiling out the total solids with three, six, or more successive quantities of ether, yields about 0·2 per cent. less fat than is obtained by two hours' treatment in a Soxhlet extractor; that no more fat is extracted by prolonged action of ether upon the solids than by merely boiling out; that granulation of the milk residue does not render the latter more amenable to the ether treatment; that 10 per cent. of absolute alcohol in the ether used for extraction but little effects the result; and lastly, that by the drying of the total solids at 110° the amount of fat is not appreciably affected, but that only the solids not fat are diminished.

IV.—Ash Determination.

A weighed quantity of milk I. was evaporated and incinerated at the lowest possible temperature—below visible red heat. Found ·68 per cent. ash. Another quantity, incinerated at red heat, yielded ·66 per cent., and a third portion, heated to bright red heat in a large Bunsen flame gave 0·64 per cent. of ash.

A sample of milk II., weighing 5·2286 grms., incinerated at the lowest practicable heat, furnished 0·0342 or 0·65 per cent. of white ash. This, heated in a Bunsen flame with gradually increasing gas pressure, fell to ·64, ·60, 0·59, and lastly, at bright red heat to ·58 per cent.

The solids not fat of the same milk, carefully incinerated, yielded 0·68 and 0·67 per cent. of ash; and in two further experiments, at red heat 0·65 and 0·62 per cent.

It follows, that identical results are obtained by incineration of the whole milk, and of the solids not fat; that is to say, that the mineral constituents of milk are quite insoluble in ether. It also appears that milk should be incinerated at the lowest possible temperature, a sensible proportion of ash being volatile at red heat.

The figures of the few simple experiments recorded above, place beyond doubt that apparently slight deviations from the commonly adopted procedure of milk examination lead to widely discrepant results, and in every instance do the modifications in the method of analysis which I have examined tend to yield a lower amount of solids not fat, and a larger percentage of fat than does the original (Wanklyn) method. Thus, taking the average of nine observations, milk solids, dried for three hours, diminished by ·14 per cent. by drying them at 100° C. to constant weight; the constant solids further diminish 0·33 per cent. when heated at 110° (average of three observations). The same milk will therefore yield after three hours drying 0·47 per cent. more solids than when dried to constancy at 110°. And further, by ether treatment in a Soxhlet extractor from 0·1 to 0·2 per cent. more fat is obtained than by the ordinary boiling out with six successive quantities of ether; so that altogether the solids not fat may readily be diminished by 0·6 to 0·7 per cent. by thorough drying and extraction, and a milk furnishing by the Wanklyn method 9 per cent. of solids not fat be credited with no more than 8·3 by other methods.

That this is a very notable difference will not be gainsaid, and Public Analysts will have to consider most seriously whether the time has not arrived to alter both the official method of analysis and the official limits.

It appears to me, that as much more concordant results are obtained when the solids are dried to constant weight than for three hours only, and that as the fat is much more completely, readily, and with a less amount of trouble extracted in an extractor such as Soxhlet's, it would be well to discard the old plan, and accordingly to lower the limit of solids not fat from 9 to 8·5 per cent. Drying at 110° is inadmissible and mischievous.

The plan then would be to dry about 5 grms. of milk for from 6 to 7 hours at 100°; to extract the dry solids for two hours in an extractor with absolute ether, again to dry the solids not fat to constancy, and then to incinerate them at the lowest possible temperature, only *one* quantity of 5 grms. being used for the whole analysis.

Such a procedure should not, however, be adopted without the full consent of all Public Analysts, in order to insure in a greater measure than heretofore absolute uniformity in the method and in the results obtained.

THE PUBLIC WATER SUPPLIES OF ENGLAND.

VALUATION, ACCORDING TO "WIGNER'S VALUATION SCALE."

Under the above heading we have published for the last nine months the valuations of the various waters, the analyses of which have appeared in this Journal from month to month. In the great majority of instances these valuations have been made by the analysts themselves, and in the cases in which they have been missed, or have been obviously incorrect, by one of the Editors of this Journal. They have been published solely on the authority of the Editors, and not as part of the Society's proceedings. It will be seen from a report of the General Meeting of the Society, which we publish on another page, that a majority have decided against the adoption of the scale as a Society's scale, and it remains as before, simply on the same footing as any other paper which has been read before the Society.

Under these circumstances it appears to the Editors undesirable to continue the publication of these monthly valuations, especially as some analysts, whose analyses are published, do not agree with the system of valuation.

ON METAPHENYLENE DIAMINE AS A REAGENT FOR THE DETERMINATION OF NITRITES IN WATER.

By A. Percy Smith, F.I.C., F.C.S., Assistant Chemical Master, Rugby School.

The use of metaphenylene diamine was introduced to the notice of the Society of Public Analysts on Feb. 16th 1881, by Mr. Williams [Analyst VI. 36]. Since then I have at various times tried to obtain from wholesale chemists, either the base, or its salts, but without success. This failure impressed me with the belief that there was some difficulty in the preparation of metaphenylene diamine, but upon trial I found that such was not the case; that is to say, it is easy to prepare a reagent that will give an orange colour with NO_2. I will not guarantee its purity. The method I have pursued is as follows:

Take of	Nordhausen Sulphuric Acid	100 c.c.
	Strongest Nitric Acid	100 c.c.
	Nitrobenzene	20 c.c.

Place in a flask, agitate, boil, and allow to stand till cold, when pour into much cold water Allow to stand for some time; filter, wash the precipitate first with cold water, and then with cold alcohol, and finally crystallize from hot alcohol, decanting the alcoholic solution from any orange oily liquid that does not readily dissolve.

The crystals which separate from the alcohol on cooling, consist chiefly of metadinitrobenzene. They should be of a very pale yellow colour, almost white, and yield M.Ph.D. on reduction by nascent hydrogen. I tried various methods of effecting this object, the most successful being by the use of iron filings and HCl. The flask or beaker may be heated. When reduction is complete, filter, *nearly* neutralize the now red liquid with KHo solution, leaving a slight amount of free acid; heat and filter from precipitated FeO. Acidify filtrate with H_2SO_4, add animal charcoal and filter; both precipitates may be washed with alcohol. The resulting solution should be colourless, or faintly yellow, and may amount to about 400 c.c. 1c.c. will give a decided colour with KNO_2 and H_2SO_4 in the manner recommended

by Mr. Williams. [op. cit.] The actual strength of the solution does not seem to be of very much importance. If economy be studied, the mother liquid from which the MDNB was crystallized may be precipitated by the addition of water, and the resulting crystals reduced, the product will however be coloured. This colour is not of much consequence, as owing to the small quantity used in testing, the tint is unappreciable.

The residue which does not readily dissolve in hot alcohol, will also yield some M.Ph.D. on reduction, but it is not worth while to do so as the solution will be highly coloured and contaminated with aniline, formed by the reduction of residual nitrobenzene.

With regard to the manner of employing the reagent, I have nothing to add to the directions already given by Mr. Williams, except that I find it convenient to evaporate the water I am testing from 500 c.c. to 100 c.c. or less.

[Note].—Since writing the above I find, on referring to Hofmann's original researches on the aromatic diamines [*Proc. Roy. Soc.* Vol. XI. 521] that he prepared phenylene diamine by *distilling* dinitrobenzene with iron and acetic acid. I have not tried this method. Hofmann does not say if he distilled in a current of H. or CO_2; I presume not. Since, however, metaphenylene diamine oxidizes with facility, it might be better to do so, or receive the distillate in weak acid so as to form a salt at once, and then crystallize.

A METHOD OF DISCRIMINATING BETWEEN OXYGEN ABSORBED BY NITRITES AND ORGANIC MATTER.

By Frank P. Perkins.

Beautiful as the permanganate process, elaborated by Dr. Tidy, undoubtedly is, its usefulness in relation to water analysis would be much enhanced were it possible to determine and definitely fix by its aid the limits of absorption of oxygen by nitrites and organic matter. The artifice at present employed—viz.: to allow the standardized permanganate to act for a few moments, and then place the oxygen consumed in that time to the credit of the nitrites—appears unsatisfactory, for evidently an approximation to the truth can only be arrived at by acting in this way. It occurred to me that oxygen absorbed by nitrites may be more correctly estimated (in an indirect manner) by altogether destroying them before applying the permanganate.

When my last paper was submitted to you, I was not aware that the action of magnesium on water was sufficient, in the cold, to decompose it rapidly enough for the purpose there required; but experiments since performed have assured me of the fact. It is advantageous, however, to favour the reaction by the addition of a small quantity of sodium chloride. Contact with platinum is unnecessary, although, if preferred, increase of power may also be gained in that way. It will be needless to enter into minute particulars: it is enough to say that the nitrites (and nitrates) having been broken up (and care must be taken by the application of some qualitative test to a portion of the water that this is effectually done) 250 c.c. of the prepared water and 250 c.c. of the water in its original condition are placed in flasks, and 10 c.c. of dilute sulphuric acid, prepared in the usual way, added to each.

The flasks are now heated, and the water brought to the boiling point; the lamp is then removed, and after a short interval 10 c.c. of the standard permanganate run into

either vessel and allowed to act for three hours, the water gradually cooling during the time. The usual manipulations accompanying the titration with hyposulphite are then gone through with, and the experiments being concluded the difference between the two represents the amount of oxygen consumed by the nitrites contained in the water.

EXETER WATER FROM TANK.

		Per 100,000 pts. oxygen absorbed.
1.	The water before being acted on by Mg.	·101
	The water after being acted on by Mg.	·068
	Difference due to Nitrites ..	·033 = ·028 N.
2.	The water before being acted on by Mg.	·103
	The water after being acted on by Mg.	·081
	Difference due to Nitrites ..	·022 = ·019 N.

FROM LABORATORY TAP.

		Per 100,000 pts. oxygen absorbed.
3.	The water before being acted on by Mg.	·0937
	The water after being acted on by Mg.	·0593
	Difference due to Nitrites ..	·0344 = ·0301 N.
4.	Experiment with Copper-Zinc Couple—	
	Water before being acted on	·098
	Water after being acted on	·0644
	Difference due to Nitrites ..	·0336 = ·0294 N.

ANHYDROUS BINOXIDE OF BARIUM.

ANHYDROUS binoxide of barium, as is well known, is a powerful bleaching agent. Treated by almost any acid, in presence of water it yields peroxide of hydrogen, the discoloring action of which chemical on the organic matters has been made use of for various purposes. In this manner raw silks, woollen and cotton fabrics, straws, skins and furs, feathers and hair can be bleached, and articles of little commercial value otherwise, or even worthless, can be made to bring remunerative prices. There is a demand for anhydrous binoxide of barium made in this country for the different uses quoted above; but until lately we have been entirely dependent upon Europe for the supply of this product. It is now manufactured in this country. An exchange says that the qualities imported have been in many cases inferior, and the prices asked entirely out of proportion with the purity of the article. But even when carefully manufactured, and of a proper strength and purity, the anhydrous binoxide imported presents a drawback. Its usefulness depends upon the amount of active peroxide of hydrogen it can yield under chemical treatment, and this quantity, which, in fact, does represent its real value, is much diminished when it has been prepared for a length of time, even a few weeks—a fact well known to chemists, and well established amongst those who know how to employ the chemical. This loss of action or of energy, so to speak, can reach as much as 15 per cent. of the original value of the substance as first prepared after a month or so, whatever care and skill might first have been given to its manufacture, and however pure it might have been originally. It is easy to realize that a transportation on steamers, besides the time it requires to make the transit, is very objectionable. Notwithstanding all the precautions taken, it is impossible to guard against the access of moisture and other sources of deterioration; and the article, however superior it might have been, is necessarily, as it reaches us, inferior to what it was when first prepared in Europe.—*New York Oil and Drug News.*

SOCIETY OF PUBLIC ANALYSTS.

Analyses of English Public Water Supplies in March, 1882. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Date when drawn.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine in Chlorides.	Phosphoric Acid in Phosphates.	Nitrogen in Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in		Hardness, Clark's Scale, in degrees.		Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
									15 mins. at 80° Fahr.	4 hours at 80° Fahr.	Before Boiling.	After Boiling.			
Kent Co.	Mar. 27	p. blue clear	none	1·84	trace	·46	·0020	·0053	·014	·024	21·4°	6·9°	33·0	satisfactory	Wigner & Harland.
New River	" 14	clear	none	1·12	trace	·23	·0007	·0021	·062	·019	14·0°	4·5°	20·7	satisfactory	B. Dyer.
East London ..	" 9	clear greenish	none	1·20	none	·38	·0017	·0025	·036	·082	15·0°	5·6°	25·4	mycm. vg. db., fib., anml.	Wigner & Harland.
Southwark & Vauxhall ..	" 25	p. y. & clear	none	1·24	trace	·23	none	·0056	·027	·052	15·5°	3·5°	19·2	satisfactory	J. Muter.
West Middlesex	" 22	greenish yellow		·98	trace	·18	·0007	·0053	·027	·062	12·5°	2·0°	20·5	none	O. Hehner.
Grand Junction	"	p. yellow		1·14	trace	·26	·0020	·0060	·028	·094	14·2°	3·7°	19·8		A. Wynter-Blyth.
Lambeth	" 25	p. y. & clear	none	1·49	trace	·29	·0007	·0049	·026	·049	16·0°	3·5°	20·7	satisfactory	J. Muter.
Chelsea	" 15	c. p. green	none	1·12	trace	·95	·0028	·0056	·036	·084	18·0°	5·0°	19·7		A. Dupré.
Birmingham ..	Mar. 7	grnsh. v. s. turb	none	2·66	trace	·31	·0028		·022	·064	11·5°	6·3°	20·4		A. Hill.
Brighton......	" 9	pale blue clear	none	2·13	none	·36	none	·0031	·008	·040	13·0°	5·0°	20·6	fibres, veg. debris	Wigner & Harland.
Bolton........	" 14	s. turbid	none	·50	none	·04	·0020	·0032	·018	·040	3·6°	3·4°	8·8	mineral and veg. debris	W. H. Watson.
Bristol........	" 6	grnsh. brown	none	·90	none	·05	·0003	·0048	·018	·040	17·4°	2·9°	19·6	sand, algæ	F. W. Stoddart.
Cambridge	" 16	c. p. blue	none	1·40	trace	·45	·0014	·0028	none	·026	16·0°	5·0°	24·5	satisfactory	J. West Knights.
Canterbury	" 17	p. blue	none	1·47	none	·33	·0050	·0050	·003	·006	4·9°	4·0°	10·0	s. mineral	S. Harvey.
Croydon	" 21	brgt. colourless	none	1·19	trace	·30	none	·0030	none	·012	15·0°	6·5°	24·6	none	C. Heisch.
Dublin........	Feb. 28	s. yellow	none	·89	trace	traces	·0010	·0040	·060	·190	1·3°	·7°	4·3	satisfactory	C. A. Cameron.
Edinburgh	Mar. 16	s. brown	none	·80	none	f. trace	·0008	·0040	·012	·050	4·7°	4·4°	5·5	none	J. Falconer King.
Exeter........	" 7	f. brnsh. yellow		·98	trace	·15	·0014	·0056	·018	·045	2·4°	2·4°	7·0	minl. and veg. diatoms	F. P. Perkins.
Grantham	" 8	c. p. blue	none	1·09	trace	·59	·0009	·0015	·006	·007	15·6°	6·6°	23·9	diatoms, mvg. orgms., &c.	A. Ashby.
Hastings......	" 15	blue	none	4·80	trace	·01	·0007	·0014	·002	·005	11·0°	6·0°	27·5	satisfactory	H. F. Cheshire.
Ipswich	" 18	c. colourless	none	2·30	trace	·28	·0036	·0060	·007	·010	19·2°	8·2°	31·2	satisfactory	J. Napier.
...g's Lynn ..	" 17	dirty yellow	weedy	1·10	trace	·31	·0007	·0063	·152	·230	19·0°	5·5°	21·2	veg. debris, diatoms mvg. [orgms. bacteria, &c.	W. Johnstone.
...rpool	" 7	yell. green	s. peaty	·95	trace	·04	·0014	·0028	·042	·100	3·4°	3·1°	7·8		A. Smetham.
...stone— Company	" 13	c. p. green	none	2·60	trace	·63		·0007	·011	·018	17·0°	7·6°	37·5	none	M. A. Adams.
(Conduit	" 13	c. p. blue	none	2·39	trace	·62		·0007	·007	·009	16·6°	7·3°	33·9	none	M. A. Adams.
...ater....	" 16	s. turb. f. yell.	none	·74	none	none	·0029	·0028	·017	·076	1·8°	1·7°	4·7	s. mineral	W. Thomson.

SOCIETY OF PUBLIC ANALYSTS.

Analyses of English Public Water Supplies in March, 1882. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Date when drawn.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine in Chlorides.	Phosphoric Acid in Phosphates.	Nitrogen in Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in 15 mins. at 80° Fahr.	Oxygen, Absorbed in 4 hours at 80° Fahr.	Hardness, Clark's Scale, in degrees. Before Boiling.	Hardness, Clark's Scale, in degrees. After Boiling.	Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
*Newark	Mar. 4	v. turb. p. brwn.	none	1·19	trace	·09	·0013	·0084	·046	·099	16·2°	11·2°	26·4	amorphs. mtr. mvg. orgms	A. Ashby.
Newcastle-on-Tyne......	" 8	s. turb. f. yell.	none	·94	trace	·04	·0010	·0090	·060	·107	16·0°	6·0°	20·0	satisfactory	J. Pattinson.
Nottingham ..	" 15	bluish green	none	1·91	trace	·74	·0020	·0124	·018	·026	10·4°	6·4°	23·4	veg. deb.	Wigner & Harland.
Norwich	" 9	f. grnsh. yell.	none	1·85	trace	·52	trace	·0060	·054	·094	14·0°	4·0°	20·0		W. G. Crook.
Poole	"				trace	·05	trace	·0032	·039	·039	1·5°	1·3°	3·6	diatoms, veg. deb., peaty	A. Angell.
Portsmouth ..	" 4	s. turbid	none	12·50	trace	·17	trace	·0042	none	none	11·5°	2·0°	18·3	veg. deb., diatoms	W. J. Sykes.
Reading	" 11	c. greenish	f. weedy	1·00	trace	·12	·0007	·0056	·033	·048	14·9°	3·8°	19·1	none	J. Shea.
Rochdale......	" 20	light green	none	·66	none	·009	·003	·004	·0007	·006	2·80°	2·80°	6·00°	satisfactory	T. A. Collinge.
Rugby	" 5	p. yellow turb.	none	1·03	h. trace	·38	·0056	·0280	·035	·102	8·0°	6·5°	14·5	veg. deb., animal.	A. P. Smith.
Salford	" 5	c. l. yellow	none	·90	none	none	·0014	·0028	·003	·035	3·0°	2·5°	5·5	none	J. Carter Bell.
Shrewsbury ..	" 17	c. colourless	none	1·45	none	·33	·0025	·0030	·004	·004	22·0°	6·0°	25·0	none	T. P. Blunt.
Southampton ..	"			·90	h. trace	·19	·0051	·0087	·015	·089	12·6°	5 0°	20·0	satisfactory	A. Angell.
Swansea	"	clear	none	·90	trace	trace	·0010	·0056	·003	·004	1·4°	1·4°	4·2	none	W. Morgan.
Whitehaven ..	" 3	c. f. green	none	·39	none	·01	none	·0008	·006	·016	·4°	·4°	2·1	veg. deb., diatoms	A. Kitchin.
Schuylkill .... Philadelphia	Feb. 21 "	turb. yellow	none	·32	trace	·107	·0063	·0084			4·0°	4·0°	6·44	veg. deb., diatoms animal.	H. Leffmann.

* The Trent was in flood when this sample was taken.

Abbreviations:—c., clear; f., faint; h., heavy; p., pale; v. h., very heavy; v. s., very slight.

ERRATA.—In the February Table the West Middlesex Free Ammonia should have been ·0013 instead of ·0130; Exeter Albuminoid Ammonia should have been ·0039 instead of ·0004; Reading Chlorine should have been ·95 instead of 1·95.

THE WORK DONE BY PUBLIC ANALYSTS DURING 1881, UNDER THE SALE OF FOOD AND DRUGS ACT.

In the course of a few days we purpose issuing forms to all Public Analysts, in order to enable us to prepare the tabulated statement which we have published for several years past. As the compilation of such a table, which is becoming larger and larger every year, necessarily occupies some considerable time, we shall be greatly obliged if analysts will fill up and return the forms with as little delay as possible.

DEFENCE ANALYSTS.

The refusal of the Home Secretary to permit a third analyst to be present on behalf of the defence during the analysis of the viscera of Percy Malcolm John, has elicited adverse comments in the public press. The reply of the Home Secretary to Lamson's solicitor, stating that the application must be refused, as it was contrary to precedent, is of course indefensible. The refusal might, however, have been made on other and better grounds. The right course was pursued of having a second analyst present in a case of such a serious nature. In his evidence, Dr. Stevenson stated that it was at his request that Dr. Dupré was appointed to assist. Both of these gentlemen were in the position of independent experts appointed by the Home Office, at the request of the coroner, to assist in the determination of the cause of death; and they were not responsible to the actual prosecuting authority, viz., the Treasury. It was not until nearly a week after the analyses were entrusted to Dr. Stevenson, that application was made for the presence of a third analyst on Lamson's behalf. By this time, the analyses must have been well in hand; and we fail to see what good result could have ensued from the presence of a gentleman responsible only to his employer, the prisoner. Were the rule introduced of having an analyst present on behalf of the defence, grave results might ensue, and the public interests would not be subserved by the change. The third party would usually be introduced at a late stage in the analysis; he could have no voice in, or control of, the analyses; his objections might or might not have weight with the official analysts. Moreover, it would be practically impossible to secure the collective attendance of three analysts eminent in their profession day by day for perhaps two or three weeks. The semblance of injustice done to Lamson by the refusal of the Home Secretary was, we believe, a semblance only; though we must admit that the refusal was made on quite insufficient and erroneous grounds.—*British Medical Journal.*

LAW REPORTS.

Oatmeal Adulteration:—

At the Yorkshire West Riding Police-court recently, Mr. William Heap, grocer, Bentley, was summoned for having adulterated oatmeal in his possession. Mr. Allen, of Sheffield, the Public Analyst, reported that the meal contained 20 per cent. of other ingredients than the meal produced from oats. On behalf of the defendant it was stated that Mr. Fairley, a well-known analyst at Leeds, had also analysed defendant's part of the oatmeal, and he stated that it was only adulterated to the extent of 5 per cent. No doubt this portion of foreign ingredient had been mixed with the meal when first it was ground at the mill. It was impossible to get oatmeal free from such ingredients. The magistrates decided to send the parcel of oatmeal still in the hands of the police for analysis by the Inland Revenue authorities. Last Saturday the report from Somerset House was produced, and it stated that the meal contained 10 per cent. of foreign matter. The defendant said he did not know he was selling adulterated meal, as he sold it as he received it from the millers. A nominal fine of 10s. and 30s. costs was impose

Mark Elvidge, Mill Lane, Burton Road, was summoned by Sergeant Richardson for selling milk which was not of the nature, substance, and quality demanded. Dr. Harrison, Public Analyst, said the milk had been deprived of one-third of its fat; it had either been partially skimmed, or else skimmed and new milk mixed. The defendant was fined 15s., including costs.

Butterine Sold as Butter.—Heavy Fines :—

At the Wednesbury Police-court, recently, Mr. Timothy Carter, grocer and provision dealer, Steelhouse Lane, Birmingham, was charged before Mr. W. F. F. Boughey (stipendiary), by Mr. Horder, the inspector under the Sale of Food and Drugs Act for the South Staffordshire district, with selling butter which was not of the quality and nature demanded by the purchaser. Mr. Stirk, of Wolverhampton, appeared for the defendant. Francis Henry Summerville, an assistant to Mr. Horder, stated that he had lately visited a stall kept in the Wednesbury Market by the defendant, and asked to be supplied with one pound of butter. An assistant supplied him with an article which he supposed to be genuine butter, for which he paid 8d. He informed the assistant that the article supplied him would be analysed by the County Analyst, Mr. Jones, and if it were found to be adulterated his employer would be summoned before the magistrate. Upon this the assistant stated that the article supplied was butterine. By Mr. Stirk: He was quite sure that he asked for butter. He was not told that the article before being supplied him was butterine. It was after it was purchased that he was informed it was butterine. It reply to Inspector Horder, witness stated that he had bought butter at 8d. per lb. which the analyst had certified to be pure. Mr. Horder stated that on the 4th inst. he received two packets from the last witness, and he delivered one of them to the County Analyst (Mr. Jones), who had since sent him a certificate to the effect that the article was not butter, and contained less than 1 per cent. of real butter fat. The analysis was—water 6·55, salt 1·32, curd 1·50, fat 90·53. Mr. Stirk said the article was no sold as butter, but as butterine, and as it was supplied by a young assistant, he trusted the Stipendiary would dismiss the case. The Stipendiary said he considered the case clearly proved, and as it was highly important that the public shonld be supplied with genuine articles, it was necessary that he, as a magistrate, should enforce the law. He considered the present case a bad one, and defendant would have to pay a fine of £5 and £1 14s. 6d. costs.

James Powell, grocer, &c., Dudley Port, was summoned on 9th December for selling adulterated butter. Mr. E. H. Thorne defended. Fras. Summerville, assistant to Mr. J. G. Horder, the inspector under the Sale of Food and Drugs Act, visited the defendant's shop on the 3rd of November, and asked for 1lb. of roll butter. Mrs. Powell gave him a sample, for which he paid 1s. A portion of the sample was afterwards analysed by Mr. E. W. T. Jones, analyst, who found that it was a fictitious article, containing only 7 per cent. of real butter fat. All the other portion was animal fat, made to represent butter. The article was butterine. For the defence, it was contended that the article was sold as butterine, and the purchaser was told so when he was supplied. Mr. Boughey, after some lengthy remarks on the fraud committed by defendant, and the worthless character of butterine, imposed a fine of £10, and said he should impose similar penalties in all these cases.

Sale of French Coffee :—

At the Cannock (South Staffordshire) Police Court, lately, before Messrs. F. V. Forster, R. H. Briscoe, and B. Gilpin, Mr. Leonard Adams, grocer, residing at Cannock, was summoned by Mr. J. G. Horder, the inspector under the Sale of Food and Drugs Act, for selling adulterated coffee. Mr. Tanner, of Birmingham, appeared for the defence. Henry Francis Somerville, assistant to Mr. Horder, stated that he visited the defendant's shop on the 16th ult., and asked for a tin of coffee, for which he paid 10d. The contents of the tin were afterwards analysed by Mr. Jones, the County Analyst, and were found to contain 72 per cent. of chicory. In reply to Mr. Tanner, Mr. Horder said he was not aware that French coffee was an extensive article of commerce. When people asked for a pure article they expected to get one. Chicory and coffee could not be looked upon as pure. Mr. Tanner contended that there was nothing fraudulent in connection with the sale, as French coffee was a well-known article of commerce, containing 28 per cent. of coffee, which was worth 4d., the chicory and the tin making up the value of the whole to 8½d. Further, the label "French coffee," protected the defendant from any action. He afterwards proceeded to quote decisions in his favour, and asserted that the magistrates could not legally convict. The Bench decided to dismiss the case; but the chairman remarked that it was a proper case to bring before the court. Mr. Briscoe said he thought it was only right that the public should know the rubbish they were purchasing. Mr. Horder said he should on behalf of the county authorities appeal against the decision.

Mustard Labelled as a Condiment:—

A case of some importance has lately been disposed of in Scotland, and as it will probably rule similar cases—at least in that part of the kingdom, we give a short note of the matter. An inspector bought a quarter of pound of mustard, and he received a tin, rolled in paper, containing what afterwards proved to be a mixture of mustard and flour, or starch. He was not told that the mustard was mixed, and although the packet bore a label saying that the contents consisted of mustard and choice condiments, his attention was not drawn to that. He paid 2s. per pound for the mixture, which was understood to be the price of pure mustard. The Sheriff convicted, and fined the defendant, who gave notice of appeal to the High Court of Justiciary (Supreme Court in Scotland). The manufacturer, who was believed to have something to do with the appeal, was understood to say that similar cases have been dismissed on appeal, and that in point of fact it is necessary to mix mustard with flour or some similar substance to make it keep. Subsequently, however, the defendant withdrew his appeal against the Sheriff's decision.

RECENT CHEMICAL PATENTS.

The following specifications have been recently published, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

No. 1881	Name of Patentee.	Title of Patent.	Price.
3100	W. R. Lake	Utilization of Carbonic Acid, &c., for obtaining Motive Power	6d.
3166	W. Morgan Brown	Electric Lamps	6d.
3189	W. R. Lake	Electric Lamps	8d.
3214	A. M. Clark	Electric Lamps	8d.
3216	W. E. Halse	Manufacture of Sugar, &c.	4d.
3378	H. F. S. D'Esplaviz	Manufacture of Artificial Manure	2d.
3149	H. R. Randall	Manufacture of Malt Extract	6d.
3281	W. A. Barlow	Purifying Oils	4d.
3286	R. E. Goolden and A. Mackay	Deodorizing and Disinfecting Agent	4d.
4011	B. Hunt	Electric Lamps	8d.
3352	W. W. Hughes	Extracting Copper and other Metals from their Ores	6d.
3402	J. H. Johnson	Electric Lamps and Manufacture of Carbons	6d.
3403	J. Duncan	Manufacture of Sugar	6d.
3535	J. C. Johnson	Manufacture of Portland Cement	4d.
3584	W. Clark	Manufacture of Sulphur, Arsenic, &c., from Gases containing combinations of these substances, &c.	4d.
3599	C. Lever	Electric Lamps	8d.
3646	H. J. Haddan	Process for Wet Extraction of Lead, Silver, &c.	4d.
3650	G. Pfannkuche	Electric Lamps	2d.
3651	C. D. Abel	Dephosphorization of Iron in Blast Furnaces	2d.
5464	K. Troback and A. Cards	Distilling Alcohol	6d.
3681	T. Hogben	Apparatus for Generating Carbonic Acid Gas	2d.
5579	C. Semper and C. Fahlberg	Removing Iron from Ferruginous Aluminous Solutions, &c.	4d.
3711	F. H. Engel	Electric Lamps	2d.
3712	C. D. Abel	Manufacture of Ammonia	4d.
5589	H. H. Lake	Refining Impure Copper	4d.

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; Journal of Applied Science; The Provisioner; The Practitioner; New Remedies; Proceedings of the American Chemical Society; Le Practicien; The Inventors' Record; New York Public Health; The Scientific American; Society of Arts Journal; Sanitary Engineer of New York; The Chemists' Journal; Oil and Drug News; Sugar Cane; Country Brewers' Gazette; The Medical Record; Oil and Drug Journal; The Canada Lancet; Gas and Water Engineering; The Grocers' Gazette; Columbia School of Mines Quarterly Magazine.

THE ANALYST.

MAY, 1882.

SOCIETY OF PUBLIC ANALYSTS.

A General Meeting of this Society was held on the 26th April, at Burlington House, the President, Mr. Heisch, in the chair.

The minutes of the previous meeting were read and confirmed.

Messrs. Dyer and Hehner were appointed scrutineers to examine the voting papers, and reported that Mr. R. Tervet, Clippens Oil Works, Analytical Chemist, and Mr. T. Harrington, Public Analyst for Cork, were duly elected as Members.

Mr. A. E. Ekins, Analytical Chemist, St. Albans, and Mr. B. Halford, Analytical Chemist, London, were proposed as Members, and will be ballotted for at the next meeting.

The following papers were read:—

"The action of Sulphuretted Hydrogen upon Compounds containing Oxide of Iron," by J. Carter Bell.

"On the Composition of Some Samples of Pure Coffee," by A. Smetham.

"The Water Supply of Toronto, Canada," by W. Hodgson Ellis.

The next Meeting of the Society will be held at Burlington House, on Wednesday, May 31st.

ON THE COMPOSITION OF SOME SAMPLES OF PURE COFFEE.

By A. Smetham, F.C.S.

Read before the Society of Public Analysts, on 26th April, 1882.

The object with which the analyses of the samples of coffee which I embody in this paper were undertaken, was to determine the variations in the composition of various qualities found in the market, and to ascertain, as far as the limited number of samples worked upon would enable me, the degree of exactitude with which the several constituents may be used in deciding the amount of adulteration when chicory is used as an adulterant. With this end in view, therefore, I have limited the estimations to those constituents which can be determined with facility as well as exactitude; but as I have been unable to complete a similar series of experiments on the various kinds of chicory, the composition of which appears to vary considerably, I am unable to do more than bring the figures before the members of the Society, in the hope that by comparison with the work of others some good may accrue.

All the samples were purchased in the roasted condition, and were ground by myself; and I can, therefore, vouch for the purity of all the samples operated upon :—

No. 1 was sold retail at 1s. per lb., under the name of Ceylon Coffee.

No. 2 as Costa Rica Coffee, at 1s. 2d. per lb.

No. 3, Plantation Ceylon Coffee, at 1s. 4d. per lb.

No. 4, East India Coffee, at 1s. 6d. per lb.

No. 5, Jamaica Coffee, at 1s. 8d. per lb.

Nos. 6 and 7, in which I have only made partial analyses, were given to me by a wholesale merchant, as representing the greatest differences in value obtainable—No. 6 being the finest, and No. 7 the commonest coffee, which he had in his possession.

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	No. 7.
Water (loss at 212° F.)	3·89	3·49	1·84	3·54	1·59	—	—
Oil (Ether extract)	12·13	11·40	10·13	10·63	10·13	11·75	10·80
Crude fibre	70·84	71·14	73·58	72·62	74·50	—	—
Cellulose	26·33	27·50	34·40	30·26	27·90	—	—
Total ash	4·63	4·29	4·40	4·08	4·19	4·25	4·20
Soluble ash	3·34	3·50	3·60	3·14	3·40	3·25	3·35
Nitrogen	2·26	2·19	2·34	2·14	2·38	—	—
Crude fibre, in sample dried at 212° F.	73·71	73·71	74·96	75·28	75·70	—	—
Specific gravity of 10 per cent. infusion	—	—	—	—	—	1009·4	1009·2

In remarking upon these results, it may be desirable to state the methods by which they were obtained :—

1. The water was determined by noting the loss in weight on drying at 212° F. in the usual way.
2. In obtaining the ether extract, 3 grms. were operated upon in an extraction apparatus, and the ether passed through until the last traces were dissolved. The oil was dried at 212° F. previous to weighing.
3. Crude fibre was obtained by boiling 2 grms. of substance with three successive quantities of water (about 100 c.c.), and washed with boiling water on a counterpoised filter until the washings were colourless. It was then dried at 212° F. until the weight was constant.
4. The cellulose was obtained by boiling with 5 per cent. solution sulphuric acid, excess of acid removed, again boiled with 5 per cent. solution caustic potash, filtered and washed with hot water. It was then treated with dilute hydrochloric acid, washed until free from acid, and then treated successively with alcohol and ether. After drying at 212° F. the weight was noted.
5. Ash and soluble ash were determined in the usual way.
6. The nitrogen was estimated by combustion with soda-lime.

The first point worthy of note is the varying proportions of water. This leads me to the conclusion that it would be desirable to dry the sample, or correct for moisture in the ordinary course of analysis. Chicory is more subject to variation in this respect than coffee, and it is obvious that a possible error, greater than the extremes of variation, may be introduced if the calculation is based in the specific gravity of a 10 per cent. infusion, and correction be not made.

The percentage of oil, although considerably higher than is found in chicory, is only useful as a check on results, as the natural variations, amounting to 2 per cent. in the seven samples examined, are sufficiently large to vitiate the accuracy of any calculations on this basis, and the difficulty is still further increased by the fact that chicory also varies in this respect.

The estimation of crude fibre in the sample dried at 212° F. appears a test which can be applied with some degree of accuracy to determine the percentage of adulteration where chicory alone is used. The extreme variation in the five samples examined is under 2 per cent., whereas the greatest difference from the average is only 1·03 per cent. The difference between the crude fibre in coffee and chicory is very wide, so that I believe this test may be used with advantage. The result obtained in this case will, of course, be practically the same as that obtained by taking the density of 10 per cent. infusion; but it has, I believe, an advantage in the fact that the extraction is complete. In working with large quantities it is necessary to filter only a portion of the infusion, and no certainty, therefore, exists that the whole of the extractive matters have been removed; whereas, by repeated boiling and weighing the insoluble we obtain a perfectly extracted residue. The time occupied is somewhat longer, but the actual labour expended is not materially increased.

The other constituents which I have determined are practically useless, except as a check on results. The soluble ash, as Mr. Allen has already shown, varies to a sufficient extent to render it of little use.

The determination of nitrogen is also a useful check, but the possible errors are as great, or nearly so, as in the case of the soluble ash.

In conclusion, I would remark that it appears to me desirable to determine the water (in order to correct), the oil, the crude fibre, the soluble ash, and the nitrogen, as well as the specific gravity of the 10 per cent. infusion in the case of adulterated samples. The average of the results will then, probably, nearly represent the percentage of adulteration where chicory only is used. The adulteration of a large quantity of the chicory found in the market complicates the matter considerably; but even in this case the error will probably be less, if the whole of the constituents enumerated above be determined, than if one only be used for calculation.

Mr. Heisch said that one of the most curious things seemed to him to be, that although the crude fibre varied so little, the cellulose varied enormously.

Mr. Kingzett thought the variations in the cellulose might be accounted for by the author not working under the same conditions.

Mr. Hehner said that cellulose determinations in roast coffee could not be but inaccurate, as the residue usually termed cellulose would be mixed with more or less carbon produced by the roasting.

Dr. Dupré referred to a recent case in which he had been engaged. Some samples of coffee were specially prepared in Birkenhead, and three of them sent to him. He determined the sp. gr. of the 10 per cent. extract, the soluble ash, the total ash, and the alkalinity. He sent in his results, and then, to his astonishment, he found the analyses were published, and the actual composition of the samples given.

Another series was sent to Mr. Jones, and others, for analysis, and the remaining one to Somerset House. The professed adulteration was as stated in the first line :—

Per Centage of Chicory actually mixed with the Samples of Coffee forwarded	A 10 Per Cent. Chicory.	B 30 Per Cent. Chicory.	C 37½ Per Cent. Chicory.
E. W. T. Jones, Wolverhampton....	7 per cent. chicory	31 per cent. chicory	38 per cent. chicory
Alfred Smetham, Liverpool	7 „ chicory	32 „ chicory	34 „ chicory
Somerset House	2½ „ not more chicory	35 „ not less chicory	48 „ not less chicory
Dr. Davies, Liverpool..............	5 to 10 „ chicory	25 „ chicory	50 „ chicory
Mr. Carter Bell, Manchester	10 „ upwards of chicory	30 „ upwards of chicory	40 „ upwards of chicory
Dr. Dupré, London.................	16 „ chicory	35 „ chicory	47 „ chicory
Dr. Vacher	Genuine	31 „ chicory	50 „ chicory

In each case his estimation was highest by taking the sp. gr. from Allen's tables. In fact, had he been contented with his own determinations of ash, he should have made them 12, 30, 40, but the sp. gr. of the solution threw it out so far. Somerset House was more out than he was.

Dr. Vacher, the analyst for Birkenhead, in his analysis of the same samples, made out the first as genuine, the second as containing 32 per cent. of chicory, and the third 50 per cent. of chicory, and wrote a letter to the *Birkenhead News*, in which he made out that his results were better than his (the speaker's), although in one case the chicory was missed altogether, and in the other two cases overstated. Dr. Dupré said he had written to the Town Clerk protesting against the publication of the analyses without asking his permission, and allowing their officer to publish a criticism of them.

Although the fact of chicory being present was certain, the amount was uncertain, and anyone who came exactly right did so by accident; any chemist would know that with such mixtures it was not possible to make exactly accurate quantitative analyses.

THE ACTION OF SULPHURETTED HYDROGEN UPON COMPOUNDS CONTAINING OXIDE OF IRON.

By J. Carter Bell.

Read before the Society of Public Analysts on 26th April, 1882.

As is well known hydrated oxide of iron and other compounds of iron are largely used in gas works for absorbing sulphuretted hydrogen; but the way in which the gas combines with the iron may vary in each case. Some oxides, though poor in iron, readily take up the gas, while others containing a large percentage of iron, owing to their physical characters, decompose the gas but slowly. I have had to examine many examples of oxide of iron, which were intended to be used for absorbing sulphuretted hydrogen, and my practice has been to pass the gas through a tube containing the oxide of iron many times, allowing the sulphide of iron which has been formed in the tube to oxidise after each passage of the gas, and at certain periods to estimate the percentage of sulphur; great care must be used, when the sulphide of iron is undergoing oxidation the temperature may rise so high as to ignite the sulphur. The following experiment will prove this:—Some oxide of iron was prepared and dried at 212° F., this was put into a tube and dry sulphuretted hydrogen was passed through; on the passage of the gas the oxide in the tube became very hot; when the contents of the tube were quite black, the tube was emptied, and the sulphide of

iron allowed to oxidise; a portion was now used for the estimation of the sulphur, the oxide was put back into the tube and the gas passed a second time, again it was turned out, this time the action was so intense that the sulphur ignited. The experiment was continued up to the fifth time, estimating the sulphur after each passage of the gas.

After passing the gas once, the percentage of sulphur was	12·28
Second time, the sulphur ignited	0·16
Third time	6·20
Fourth time	8·68
Fifth time	16·60

Two samples were taken, No. 1 was a Lincolnshire iron ore containing about 35 per cent. of metallic iron. No. 2 was a slag from an iron foundry containing about 55 per cent. of iron. Sulphuretted hydrogen was passed through these over one hundred times, with the following results :—

	Percentage of Sulphur. 1	2
After passing H_2S 10 times	33·671	24·926
,, ,, 20 ,,	38·521	34·762
,, ,, 30 ,,	41·729	37·891
,, ,, 40 ,,	43·916	42·918
,, ,, 50 ,,	46·512	43·769
,, ,, 70 ,,	55·321	54·261
,, ,, 90 ,,	60·122	60·571
,, ,, 110 ,,	63·816	65·789
,, ,, 140 ,,	—	71·564
,, ,, 160 ,,	—	74·612

Mr. Heisch said they were all perfectly aware of the great difference in the absorptive powers of samples of iron of sulphuretted hydrogen; some samples sent to gas works were of no use at all, and very few of them in practice reached 74 per cent.

Dr. Dupré asked if the President was acquainted with any instance where a mixture of sulphur and iron actually took fire on exposure to the air—the sulphur being in a fine state of division.

Mr. Heisch said that after it had been exposed to the air once or twice, a large amount of free sulphur was obtained, and this free sulphur became fired if they oxidized too quickly.

Mr. Wigner said a shower of rain was quite sufficient to fire a charge brought out from a purifier.

Mr. Lyte said he had seen it spontaneously fire.

THE WATER SUPPLY OF TORONTO, CANADA.

By W. Hodgson Ellis, M.B., School of Practical Science, Toronto.

Read before the Society of Public Analysts on 26th April, 1882.

During the past six months I have made monthly analyses of the water supply of Toronto, according to the instructions published in The Analyst, the results of which are embodied in the following table.

Toronto is situated on the shores of a bay which is nearly closed by a long sandy island, which is situated opposite the town. At each end of the island there is a narrow

channel between the island and the main land. The sewage of the town is poured into this basin at various points along the shore, and the water supply is drawn from the opposite or island shore of the basin, and brought by a pipe across the basin a distance of 4,500 feet.

Dangerous as is such a source of supply, sewage contamination does not seem to have occurred to any appreciable extent, owing, doubtless, to the large size of the basin, and to the fact that a current continually blows through one gap and out of the other, and thus sweeps the foul water away.

A sample of the water of the bay, close to the mouth of one of the principal sewers, gave :—

Ammonia	·0196
Albuminoid Ammonia	·0154
Chlorine	·336

A sample of water from the lake, outside the island, gave :—

Ammonia	·0013
Albuminoid Ammonia	·0084
Chlorine	·203

Analysis of the Toronto Water Supply for the Six Months ending March, 1882.

GRAINS PER GALLON.

	October.	November.	December.	January.	February.	March.
Colour.	pale yellow.	pale yellow.	pale yellow.	pale greenish yellow.	chalky white.	chalky wht. sly. turbid.
Smell at 100° F.	veg. mattter.	none.	none.	none.	none.	none.
Chlorine in Chlorides.	·21	·23	·21	·21	·21	·21
Nitrogen in Nitrates.	·015	·0161	·0132	·0184	·0156	·0173
Phosphoric Acid in Phosphates.	none.	none.	none,	none.	none.	none.
Ammonia.	·0028	·0013	·0008	·0056	·0022	·0014
Albuminoid Ammonia.	·0098	·0076	·0028	·0154	·0056	·0063
Oxygen absorbed at 80° F. in 15 min.	·0223	·0308	·0196	·0342	·0216	·0154
Oxygen absorbed at 80° F. in 4 hours.	·0463	·0476	·0411	·0658	·0496	·0560
Hardness—Clarks' Scale before boiling	6·5°	7°	7°	6·5°	6·5°	6·5°
Hardness after boiling.	2·0°	2·5°	2·5°	2·5°	2·5°	2·°
Total Solid Matter dried at 220° F.	9.50	9·52	9·80	10·36	9·66	9·24
Microscopical Exam.	vegetable deb. diatoms, algæ and infusoria.	vegetable deb. algæ, diatoms, infusoria.	algæ, diatoms, infusoria.	algæ, diatoms, infusoria.	algæ, diatoms, infusoria.	algæ, diat., infusoria.

We hope next summer to get water from the open lake (Ontario) beyond the island. When this is effected, I hope to send the analysis of the water from this source.

BREAD ANALYSIS IN MASSACHUSETTS.

A recent report of the Massachusetts Board of Health gives the following interesting particulars as to the analysis of samples of bread bought in the State. One hundred and three samples of bread were tested for alum. Of these seven were known to contain it, and two known to be free from it. Of the remaining number, seven contained a very small quantity, less than one-tenth of one per cent., and eighty-eight were entirely free from it. These ninety-five samples were purchased from as many different bakehouses, without it being known to the baker for what purpose the bread was to be used. Twenty

of these samples were also incinerated, and the ash examined for other mineral adulteration—but none was found. All the bread examined looked, smelled, and tasted well. The moisture was estimated in thirteen samples, and varied from 31·42 per cent. to 65·27 per cent. Only four of these contained over 38 per cent. The fat was estimated in house-made and in baker's bread. The two samples of home-made bread gave 1·12 per cent. and 1·17 per cent.; four of baker's gave 1·33 per cent., 1·34 per cent., 1·10 per cent., and 2·10 per cent. respectively. This would show that there is no important difference in the amount of moisture and fat in baker's bread and that ordinarily made in families. The "logwood solution" was used in testing for alum. This, though criticised, never failed to show alum when it was known to be present; and it is so delicate that it will show the presence of less than one part in ten thousand of crystallized alum in bread, and will do this even after the bread has been baked a month, and has become covered with mould. This was proved by the following experiment: samples of pure flour that had been tested were mixed with known amounts of alum, and baked in the ordinary way, taking care that no alum was introduced. The test worked very satisfactorily, both upon the samples of flour thus prepared and the bread which had been made from them.—*Sanitary Record.*

ACTION OF ORGANIC MATTER ON SILVER SALTS.

By Wm. Ripley Nichols.
Mass. Inst. Technology, Boston.

In the March number of The Analyst occurs a paper "On the Action of Organic Matter on Silver Salts," by Henry Leffman, M.D., Microscopist to the Pennsylvania State Board of Agriculture. In this article occurs the rather remarkable statement: "The action of organic matter upon silver salts is well known, but I am not aware of any attempts to utilize this method for the examination of water."

Although less commonly employed than the chloride of gold, nitrate of silver has long been used, and is still frequently used, as a qualitative test for organic matter in water. That it was the custom to apply this test forty and fifty years ago, appears from the water reports of 1830-40. For example, I have in my hand at the moment a report of Dr. C. T. Jackson, dated July 1, 1834, and Silliman's Report on the Analysis of the Waters, dated October 29, 1845, in both of which the test is used without special remark. When the test was *first* used I do not know. Glauber knew that nitrate of silver would blacken hard wood so as to make it look like ebony, and would also colour hair, feathers, &c. (*Mirac. Mundi Explic.*, Amsterdam, 1656, p. 44.) In a number of mineral water analyses reported between 1750 and 1800, the nitrate of silver seems to have been used merely as a test for chlorides; but in Baumé's *Chymie Expérimentale* (Paris 1773), nitrate of silver is used to see whether a mineral water contains any "principe phlogistique ou sulfureux": if the precipitate is white, it is a sign that the water is not charged with "matière inflammable."

Coming to later times, the author of the paper alluded to ignores utterly Fleck's method for the *quantitative* use of the test, and for distinguishing thereby between what he designates as "Moderstoffe" and "Fäulnissstoffe." Fleck's method was first published in the *Journal für Prakt. Chemie*, iv. (1871), p. 364, and is given in Tiemann's *Anleitung zur Untersuchung von Wasser*. Fleck has published the results of the examination of a considerable number of samples of water by this method in the various annual reports of the *Chemische Centralstelle*, in Dresden. Although this method has not been used to a very great extent except by its originator, it is, I presume, well known to water analysts.

SOCIETY OF PUBLIC ANALYSTS.

Analyses of English Public Water Supplies in April, 1882. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Date when drawn.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine in Chlorides.	Phosphoric Acid in Phosphates.	Nitrogen in Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in: 15 mins. at 80° Fahr.	Oxygen, Absorbed in: 4 hours at 80° Fahr.	Hardness, Clark's Scale, in degrees: Before Boiling.	Hardness, Clark's Scale, in degrees: After Boiling.	Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
Kent Co.	Apr. 17	p. blue clear	none	1·56	none	·40	·0010	·0	·012	·024	20·0°	5·0°	33·2	veg. deb., mycm., anml.	Wigner & Harland.
New River	,, 15	c. faint yellow	none	1·12	trace	·22	·0014	·0028	·025	·030	14·0°	3·5°	17·9	satisfactory	B. Dyer.
East London ..	,, 17	c. grnsh. yellow	none	1·35	trace	·16	·0026	·0047	·016	·026	13·6°	4·4°	23·2	veg. debris, animalculæ	Wigner & Harland.
Southwark & Vauxhall ..	,, 26	v. p. y. & clear	none	1·24	trace	·20	·0007	·0050	·038	.061	14·5°	3·5°	20·3	satisfactory	John Muter.
West Middlesex	,, 25	greenish yellow	none	1·02	trace	·12	·0005	·0047	·017	·040	12·0°	2·0°	19·1		O. Hehner.
Grand Junction	,,	p. yellow	none	·98	trace	·13	·0018	·0046	·009	·074	14·3°	3·7°	21·7		A. Wynter-Blyth.
Lambeth	,, 26	v. p. y. & clear	none	1·24	trace	·20	·0007	·0050	·038	·061	14·5°	3·5°	20·3	satisfactory	John Muter.
Chelsea	,, 25	c. p. yellow grn.	none	1·12	trace	·11	none	·0042	·017	·031	16·0°	5·0°	20·3		A. Dupré.
Birmingham ..	Apr. 12	turbid greenish	none	·91	trace	·11	·0021		·006	·023	9·1°	5·8°	16·9	vegetable debris	A. Hill.
Bolton	,, 12	s. turbid	none	·58	none	·04	·0014	·0050	·012	·028	3·2°	3·0°	8·1	mineral mtr., veg. debris	W. H. Watson.
Brighton	,, 11	c. p. blue	none	1·91	none	·30	·0014	·0037	·006	·012	12·0°	5·0°	22·8	vegetable debris	Wigner & Harland.
Bristol	,, 3	grnsh. brown	none	·90	none	·06	none	·0063	·011	·067	16·2°	2·1°	21·6	sand, algæ	F. W. Stoddart.
Bury (Lanc.) ..	,, 1	s. turbid	s. mossy	·95	none	·04	·0040	·0093	·012	·024	4·5°	4·2°	8·7	satisfactory	W. H. Watson.
Cambridge	,, 15	c. p. blue	none	1·40	trace	·34	none	·0010	·008	·016	18·0°	5·0°	25·2	satisfactory	J. West Knights.
Croydon	,, 25	c. colourless	none	1·12	v. h. traces	·14	none	·0030	none	·006	16·5°	4·5°	24·4	none	C. Heisch.
*Darlington ..	,, 15	brnsh. yellow	peaty	·59	trace	·04	·0028	·0070	·195	·333	5·0°	4·5°	7·8	satisfactory	W. F. K. Stock.
Dublin	Mar. 31	s. yellow	none	·85	trace	traces	·0020	·0050	·060	·198	1·36°	·7°	4·2		C. A. Cameron.
Edinburgh	Apr. 12	s. brown	none	·80	none	traces	traces	·0056	·012	·038	4·2°	3·7°	5·2	none	J. Falconer King.
Ely	,, 15	p. yell. s. turbid	s. weedy	1·61	trace	·23	·0005	·0091	·046	·086	19·0°	6·5°	30·1	diatoms, desmids., &c.	J. West Knights.
Exeter	,, 11	f. brnsh. yellow		·91	trace	·15	·0007	·0028	·030	·049	2·4°	2·4°	6·3	satisfactory	F. P. Perkins.
Grantham	,, 12	c. p. blue	none	1·12	trace	·60	·0005	·0015	·004	·007	15·5°	4·3°	23·0	satisfactory	A. Ashby.
King's Lynn ..	,, 12	yellow	weedy	1·49	trace	·35	·0008	·0105	·192	·437	14·5°	5·5°	19·3	veg. debris, diats., bact.	W. Johnstone.
Leamington ..	,, 19	c. greenish	none	1·54	none	none	·0021	·0014	none	·005	25·0°	11·9°	26·6	satisfactory	A. Bostock Hill.
Liverpool	,, 17	yell. green	s. peaty	·95	trace	·02	·0007	·0028	·036	·067	3·5°	2·7°	6·7		A. Smetham.
Maidstone—															
Wtr. Company	,, 15	c. p. green	none	2·90	trace	·33		·0021	·011	·013	16·1°	5·7°	34·3	satisfactory	M. A. Adams.
Public Conduit	,, 15	c. p. blue	none	2·20	trace	·35		·0014	·009	·010	16·0°	5·5°	32·3	none	M. A. Adams.

* River in flood.

SOCIETY OF PUBLIC ANALYSTS.

Analyses of English Public Water Supplies in April, 1882. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Date when drawn.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine in Chlorides.	Phosphoric Acid in Phosphates.	Nitrogen in Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in		Hardness, Clark's Scale, in degrees.		Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
									15 mins. at 80° Fahr.	4 hours at 80° Fahr.	Before Boiling.	After Boiling.			
Manchester....	Apr. 26	v. sl. tb. f. yl. col.	none	7·45	none	none	·0030	·0027	·022	·077	1·7°	1·6°	4·5	slight mineral sediment	William Thomson.
Newark	„ 6	c. blueish green	none	1·19	trace	·05	·0011	·0032	·011	·025	17·0°	12·2°	34·9	satisfactory	A. Ashby.
Newcastle-on-Tyne......	„ 12	f. yellow	none.	·91	trace	·03	·0010	·0008	·062	·108	14·4°	5·4°	19·0	satisfactory	J. Pattinson.
Nottingham ..	„ 17	s. opq. grnsh.	slight	1·84	none	1·40	·0021	·0032	·006	·012	14·8°	6·8°	30·2	veg. debris, mycelm.	Wigner & Harland.
Norwich	„ 11	p. grnsh. yell.	none	1·70	trace	·11	trace	·0030	·039	·074	12·0°	3·7°	16·8		W. G. Crook.
Portsmouth ..	„ 13	s. turbid	none	1·23		·18	trace	·0042	none	none				veg. deb., diatoms	W. J. Sykes.
Rochdale......	„ 22	light blue	none	·60	none	none	none	·0010	none	·006	3·6°	3·0°	7·2	satisfactory	T. A. Collinge.
Rugby	„ 2	p. yell. turbid	none	1·17	h. trace	·19	·0072	·0142	·040	·095	15·0°	7·5°	19·6	veg. deb., diatoms	A. P. Smith.
Salford	„ 4	c. s. yellow	none	·80	none	none	·0028	·0042	·014	·070	4·0°	3·5°	9·0	none	J. Carter Bell.
Southampton..	„ 24	pale yellow	none	·95	trace	·14	·0023	·0063	·018	·088	14·5°	5·0°	19·2	satisfactory	A. Angell.
Swansea	„ 17	clear	none	1·00	trace	none	·0010	·0049	·003	·004	1·5°	1·4°	4·2	none	W. Morgan.
Whitehaven ..	„ 11	c. f. green	none	·44	none	·01	none	·0007	·007	·015	·4°	·4°	2·0	veg. deb., diatoms	A. Kitchin.
Schuylkill .... Philadelphia	Mar. 22 „	v. s. yellow	s. musty	·37	none	·124	·0007	·0056			4·0°		6·1	none	H. Leffmann.

Abbreviations:—c., clear; f., faint; h., heavy; p., pale; v. h., very heavy; v. s., very slight.

ERRATA.—In the March Table, New River Water, the figures for Oxygen absorbed in 15 minutes and 4 hours were transposed; Portsmouth Chlorine should be 1·25 not 12·5.

OFFICIAL CHEMICAL TESTS OF IMPORTED ARTICLES IN THE NEW YORK LABORATORY.

THE United States laboratory, established as an adjunct of the appraiser's department at this port, has been in existence since 1858. A writer in the *New York Times* says that up to the period of the establishment of the laboratory, the Custom-house authorities had been in the habit of employing expert chemists, from time to time, as necessity demanded, but the expenditure for this kind of service increased so steadily and so largely that it was deemed best to organise a government laboratory. Professor Edward Sherer, who had had several years practical experience in applying chemical tests to various imported articles for large wholesale house in New York and elsewhere, was placed in charge of the laboratory. At the present time Professor Sherer has four assistants, each of whom attends to a special branch of the work. The laboratory has proved itself to be a good financial investment on the part of the government. By reason of the chemical tests applied to imported sugars, &c., many cargoes of goods have been raised in their respective classifications, and thereby made to pay a higher rate of duty than otherwise would have been collected.

The collecting of duties on the numerous dyestuffs which are classed under the head of aniline colours causes the government and importers considerable trouble and annoyance. Aniline colours have to pay a high duty. There is a specific duty of 50 cents per pound, and an *ad valorem* duty of 35 per cent. There are several dyes, Professor Sherer says, which resemble aniline colours, and which, under the law, are dutiable as aniline, but the importers frequently have them entered as an inferior quality of stuff. Chemical analysis, however, quickly determines the character of the dyes, and duties are levied as the law directs. The importers of dyestuffs have paid the extra duties under protest, and several appeals from the appraisers' decisions are now pending.

Opium is constantly coming under the professional eye of the government chemist. In order that none but pure drugs may be brought into this country the law has provided certain stringent restrictions. No opium is admitted by the Custom-house officers if it is found to contain less than 9 per cent. of morphine. Prior to last year there were a number of instances where the chemical analysis showed the opium brought to this port to be deficient in the necessary quantity of morphine. During the last twelve months, however, there has been very little reason to find fault with the quality of opium imported. Nearly 190 tests were made during 1881.

There are several varieties of mineral water imported, to which analytical tests are applied for the purpose of ascertaining whether they are natural or manufactured waters. The latter, of course, are subject to duty, while the former are admitted free. In the case of Apollinaris water, it was ascertained by Professor Sherer that a large percentage of the salt and gas in the water was added artificially. Appraiser Howard consequently imposed a duty on that particular water, but for some reason the Treasury Department decided to admit it free. Vinegar, before it can pass the Custom-house authorities, is analyzed to ascertain the percentage of acetic acid which it contains. Vinegar is taxed according to its strength, the higher the degree of acetic strength the greater the duty. Metals and all alloys are required to pay a duty in accordance with a graded tariff based on their value. The chemical analysis is made for the purpose of finding out the proportion of differen

etals in all of the alloys that are being constantly imported. Colcothar (pure oxide of on) is free under the tariff, and some importers take advantage of that fact to bring in any varieties of painters' colours under the name of colcothar. Of 158 specimens of -called colcothar analyzed by Professor Sherer and his assistants last year, not more than e-quarter of them were found to be pure colcothar.

Immense quantities of bone-blacks are imported into the United States annually, and ere are sugar refiners who attempt to get them through the Custom-house free, under the etext that they are merely calcines or burned bones. The latter are on the free list, hereas bone-black, which is used in the refining of sugars, is dutiable at 25 per cent. *ad lorem*. Nearly 200 chemical tests of this material were made by the chemists of the nited States laboratory during the last year, and in every case the stuff entered as calcines burned bones was found to be bone-black.

The alcohol exported and perfumery made in bond is analyzed, in order to determine e amount of the rebate which the law allows the exporter.

The total number of analyses made by the attachés of the laboratory during the year 381 were 4,975, a few of which were made in Philadelphia, Boston, Baltimore and New aven. The cost to the Treasury Department of the analytical work alone, if paid for at e lowest contract rates charged by chemists of repute, would, it is claimed, be from),000 to 25,000 dollars, and the cost of the special investigations conducted under the rection of the laboratory, if made by chemists not in the employ of the department, cannot definitely estimated. The actual expenses last year were 9712 dols. 26 cents.—*New ork Oil and Drug News.*

PARLIAMENTARY NOTES.

COFFEE AND CHICORY.

the House of Commons, on the 3rd April,

Sir E. Lechmere asked the President of the Board of Trade whether the Treasury inute of the 20th of January, 1882, by which the importation, under a duty of twopence pound, of "coffee or chicory, roasted and ground, mixed, without reference to the pro- ortion of the mixture, and the permission to extend to any other vegetable matter applicable the uses of chicory or coffee," was made upon the recommendation of the Board of rade, as stated in the reply to a memorial lately presented to the Lords Commissioners of e Treasury upon the subject; and, if so, if he would explain the reasons for such a recom- endation, which appeared to be in contradiction to the Adulteration of Food Acts.

Mr. Chamberlain: As the subject of this question has excited a good deal of interest, I n much obliged to the hon. baronet for giving me an opportunity of making an explanation. should say, in the first place, that the change in the Treasury regulations does not make ny alteration whatever in the law with regard to adulteration; nor does it in my opinion nd to increase the practice of adulteration. The matter was brought to my knowledge in e first instance by a number of tradesmen of Leeds and elsewhere, who complained of hat they considered to be the anomaly in the Customs regulations. They informed me at while coffee which was pure could be imported, and that chicory and other vegetable bstances applicable to the use of coffee could also be imported, and, having been imported,

could be legally mixed in this country and legally sold, the same articles could not be imported if they were mixed abroad. When I came to enquire into the matter I found that the anomaly had arisen from the fact that at one time the duty on chicory differed from the duty on coffee, and that it was necessary that it should be imported separately and not be allowed to come in mixed. The regulation was purely one relating to revenue, and was not passed to prevent adulteration. The change which has been made amounts to this only, that whereas previously coffee and chicory could only be imported separately, and mixed afterwards, they can now be imported ready mixed. I should say that the interests of the consumer are protected not by any regulations of the Customs, but by the provisions of the Adulteration Act. The Sale of Food and Drugs Act provides that no article of food, or drug, shall be mixed with any ingredient injurious to health and sold, under a penalty of £50, and that no article shall be sold to the prejudice of the purchaser mixed with any ingredient, unless at the time of the sale the article so sold is described as mixed. Under these circumstances I think the interests of the consumer will be protected, because the local authorities can step in and secure a penalty of £50 against any tradesman who sells coffee mixed with chicory or with any other things not injurious to health.

In reference to this subject it will be seen from the annexed resolutions which were introduced by Mr. Gladstone in his Budget speech on the 24th ultimo, and have been passed by the House of Commons, that the sale of coffee mixtures containing such things as dates, malt, figs, will now be entirely illegal, and chicory alone may be mixed with coffee.

These resolutions are:—"Resolved, that the duty of Excise on vegetable matter grown in the United Kingdom, applicable to the uses of chicory or coffee (other than chicory,) shall cease to be payable, and the sale or exposure for sale of any such vegetable matter in imitation of, or mixed with, chicory or Coffee shall be rendered 'illegal.'" And, "Resolved, that the duties of Customs on vegetable matter applicable to the uses of chicory or coffee (other than chicory) shall cease to be payable, and the importation as merchandise of any such vegetable matter mixed with coffee or chicory shall be prohibited."

Willow Leaves and Tea.—A chop of tea, consisting of upwards of 100 half-chests, recently imported from Hong Kong as "extra choicest Ningchow Congou," was sold publicly on February 28th, at from 6d. to 6¼d. per lb. The teas have been re-sold at a profit, and distributed throughout the Kingdom, and some have also been shipped to the Continent. The top of the package consists of sound tea, but the remainder is composed of willow or other leaves mixed with some substance which has become putrid. The appearance of the dry leaf, however, is such as to justify the Custom House and the Dock authorities passing it into consumption. According to the terms of sale, no allowance is usually made on account of any damage, rubbish, or false packing, after the goods have left the warehouse; but in this instance, it is understood, the selling brokers have allowed the packages to be returned. The Customs authorities, however, refuse to return the duty which has been paid.—*Grocer.*

Mr. Alfred Ashby has been appointed Public Analyst for the Borough of Newark.

THE WORK DONE BY PUBLIC ANALYSTS DURING 1881, UNDER THE SALE OF FOOD AND DRUGS ACT.

As announced in our last number, we have sent forms to nearly every Public Analyst in the United Kingdom. We have received a very large number of returns, but many are still missing. We shall be glad if those analysts who have not yet sent their returns will do so at once, so that the tabulated statement may be as complete as possible.

OFFICIAL ANALYST IN POISON CASES..

The President of the Royal College of Physicians of London has nominated Dr. Stevenson, of Guy's Hospital, to the post of scientific analyst to conduct any analyses of bodies of deceased persons that may be ordered by the Secretary of State in the interests of justice during the year beginning May 1st instant.

REVIEW.

New Commercial Plants and Drugs, No. 5.

By Thos. Christry, F.L.S. London: Christy & Co.

The author of this work is supplying a want long felt by colonists and others engaged in agricultural pursuits in tropical and semi-tropical countries, by drawing attention to plants hitherto to a great extent neglected, containing substances of sufficient commercial importance to render them well worthy of careful cultivation.

In the article on tannin and tanning materials the author does not confine himself to the substances commonly used in this country for the preparation of leather, but gives a list of the trees, plants, and shrubs containing anything like a notable proportion of tannin; in most cases analyses are given; in one or two instances, however, more particularly in the case of the betel nut (*Areca catechu*), although the production in Penang alone is said to amount to upwards of 8,000 tons, yet no mention is made as to the quantity of tannin which these nuts contain, nor are any hints given as in other cases as to a mode of rendering these valuable nuts useful for other purposes besides the preparation of a chewing material for Malays and Indians.

We should feel inclined to doubt the statement of the author that leather tanned with the peel of the pomegranate rind (*Punica granatum*) is little affected by the atmosphere of a room in which gas is burnt, as we question whether morocco or any other leather will long withstand the action of the products of combustion of London coal gas without suffering some amount of deterioration.

We should recommend all who are interested in the extended use of coca, coraiba leaves, papav. and other drugs, to read the concluding chapter.

On the whole, the number contains a variety of sound and practical information, a great deal of which is of such a nature as to be directly available to persons interested in the culture, preparation, and sale of the articles of commerce treated upon. The author is also prepared to report upon plants and seeds likely to contain new commercial products, and to give advice as to the best mode of culture.

CORRESPONDENCE.

[The Editors are not responsible for the opinions of their Correspondents.]

BACTERIA.

To the Editor of "The Analyst."

Sir,—May I ask, through your columns, what is understood amongst water analysts by the term *Bacteria?* I do this from no mere idle curiosity, but because I have reason to believe that there exists a considerable amount of confusion in the minds of many persons as to what should be included under the term *Bacteria*. For instance, a Public Analyst, a friend of mine, writing about the Lynn water, makes use of the following expression:—"*Bacteria*, which, according to Dr. Cohn, includes all the very minute spherical, elongated, rod-like, straight and spiral filamenous plants endowed with more or less active spontaneous motion."

Now this definition may include not only *Bacterium* (Duj.), but also *Bacillus* (Cohn), *Micrococcus* (Hall), *Spirochæte* (Ehr), *Spirillum* (Ehr), *Vibrio* (Ehr), *Beggiatoa* (Trev.), and a host of allied genera, which have during the past 50 years been recognised by students of this science. I must confess, however, that when I hear a water spoken of as containing *Bacteria*, I naturally connect the term with the genus *Bacterium*, of which *B. termo* (Ehr), *lineola* (Cohn), and *rubescens* (Ray-Lank) are the types. If it be the custom of the profession of analysts to use the word in its more extended sense, I think it would be only fair to the general scientific public to let them know such is the case.

I am, Sir, yours obediently,

CHARLES B. PLOWRIGHT,

7, *King Street, King's Lynn.* *Medical Officer of Health.*

ARTIFICIALLY INCREASING THE QUININE HARVEST.

To the Editor of "The Analyst."

Sir,—Referring to the singular experiments at present being conducted in Ceylon by a Mr. Schrottky with the object of increasing, by a process of inoculation, the quinine in cinchona bark, I have much pleasure in handing you the following corroborative testimony from my brother, Mr. Michael Cochran, M.A., F.C.S., as to the experimental success so far of the suggestion. He writes from Colombo, Ceylon, under date 24th March, as follows:—"I have been analysing some cinchona bark for a chemist named Schrottky, who has been trying to increase the percentage of quinine in the bark of trees about to be cut down, by causing them to absorb certain chemicals. He takes a ring of bark off the tree near the root, applies a solution, then, after about eighteen days, the bark is taken off. I analysed two sets of samples from the same trees before and after treatment, the sample being taken from the same height in each case; the increase of quinine was marked while the total alkaloids varied but little."

Should more extended observations confirm this result, it is hardly necessary to add that the pecuniary advantages likely to accrue to owners of well-grown cinchona plantations in Ceylon and elsewhere, will soon prove highly important, and quinine, so necessary a febrifuge in tropical climates, may at no distant date be brought well within the means of even the poorest coolie.

I remain, Sir, your obedient Servant,

Overdale, Dunblane, Perthshire, 17th April, 1882. WILLIAM COCHRAN.

THE LACTOBUTYROMETER IN MILK ANALYSIS.

To the Editor of "The Analyst."

Sir,—In Dr. Vieth's paper on milk analysis, reported in the issue for April, he refers to the lactobutyrometer as quite a new instrument. I have not seen the instrument referred to, but from the description, it is similar, if not identical with Horsley's Milk Tube, which is worked in identically the same manner, and with the same proportions of ether and alcohol. This instrument was discountenanced when first introduced, and I suppose very few laboratories possess such a thing now-a-days.

I have had one for a number of years, and used it continually for the estimation of fat in milk, and have always found it accurate and speedy. If, however, the complete analysis be carried out by Horsley's directions then the process becomes more lengthy than the usual method.

" There is nothing new under the sun." Certainly the lactobutyrometer, although re-christened with a longer name, is no exception to the proverb.

I am, yours, &c.,

THOS. W. DRINKWATER.

Chemical Laboratory, Marshall Street, Edinburgh.
4th April, 1882.

REPORTS ON ADULTERATION IN THE STATE OF NEW YORK.

In this number we reprint, from the *Sanitary Engineer* of New York, the first of a series of Abstracts of Reports which have been presented to the New York State Boards of Health by the analysts appointed, as we announced last September, to examine and determine the extent of the adulteration practised in articles of food and drugs sold in the State. This examination is, as we mentioned, simply of a preliminary nature, but the Reports contain matter of so much interest to English analysts that we need make no apology for reprinting the admirable abstracts made by the *Sanitary Engineer*. The samples examined were collected by two inspectors appointed by the Board of Health.

ANIMAL FOOD.

Group I.

MILK: FRESH AND CONDENSED.

Report by Prof. C. F. Chandler, Ph.D., of New York, with whom was afterwards associated C. E. Munsell, Ph.B.

The first part of the report is devoted to the composition of pure milk, and the most common frauds, which consist of watering, skimming, or both.

The frauds in milk differ from those of most other articles of food, in that pure milk varies in composition to a very marked degree, making it impossible to establish a standard of purity except by selecting for this purpose the poorest milk produced by healthy cows. As the frauds generally consist in increasing the amount of water, or diminishing the amount of fat (skimming), the chemist can only decide by his examination whether the frauds practiced have reduced the original milk below the standard adopted.

The report then details the investigations by which the standard has been fixed. The minimum specific gravity of 1·029, which has long been the standard in Europe, was confirmed by the examination of nearly 1,000 cows in New York State, New Jersey, and Connecticut. The maximum specific gravity was 1·0394, or 136 on the lactometer. It came from an Alderney cow. The lactometer employed, therefore, is the one in use in Europe, on which 0 stands for the specific gravity 1,000, or that of water, and 100 stands for that of 1·029 which is the specific gravity of the poorest normal milk from healthy cows. Thirty-eight analyses of pure milk were made by C. E. Munsell, and 12 more are quoted which were made by Elwyn Waller, Ph.D. The standard adopted by the English Society of Public Analysts and the New York City Board of Health is confirmed and adopted in this report. It is for the poorest milk from a healthy cow. Fat, 2·5 per cent.; solids, not fat, 9 per cent.; water, 88·5 per cent. From the examination of commercial milk it appears that the sophistications of this article of food are extremely common. While a large proportion of the milk sold has been but moderately watered and skimmed, and is still above the standard of the poorest milk, much of the milk has been extended and skimmed far below this standard.

So openly are these frauds practiced that "creameries" have been established in many localities; the names and locations of seventy-three of such establishments being known to the writers, of which sixty-three are known to send skimmed milk to New York city, all of which is sold as whole milk on its arrival. Special attention was paid to the use of brewers' grains as food for cows.

It is found that when these grains are used in moderate proportions with good pasture, or hay, &c., and the cows are properly cared for, no evil results occur either in the quality of the milk or the condition of the animals. The excessive use, however, of this food has a very bad effect on the cows.

The condensed milk as sent to customers in New York city was carefully analysed and found to be unobjectionable and of good strength, except in one or two cases, where the small percentage of fat showed that the milk must have been partially skimmed before it was condensed.

(To be continued).

ANALYSTS' REPORTS.

At the Breconshire Quarter Sessions, Mr. W. Morgan, the Public Analyst, stated that among the samples submitted to him for analysis during the past quarter was one of pepper, which he found to be genuine.

The County Analyst for the West Riding of Yorkshire, in his annual report, states that the total number of samples examined during the year was 218, against 192 in the previous twelve months. Of the entire number, thirty, or 13·8 per cent., were adulterated to a serious extent; and an additional nineteen, or about 9 per cent., were of very inferior quality, of doubtful purity, or impure to an insignificant extent. The remaining 169 samples were genuine, or not found to be adulterated.

Out of the seventeen samples of food and drink submitted for analysis to the County Analyst for Cumberland, Mr. J. W. Montgomery, only one was found to be adulterated, and that was gin, which was diluted with water to a greater extent than is allowed by law. The samples were as follows: three of rum, two of whiskey, one of gin, one of brandy, two each of pepper, mustard, and coffee, and one each of lard, sago, tea, and milk. This satisfactory report is held to be highly creditable to the tradesmen of the district.

Dr. Alford, the Public Analyst for the county of Somerset, reported at the Quarter Sessions, held at Wells, that during the past quarter he had analysed 141 samples of food and drugs, among which were thirty-three samples of butter, five samples of pepper, thirteen of mustard, two of coffee, one of cornflour, eighteen of tea, one of sugar, two of jam, seven of arrowroot, one of sago, one of magnesia. Of the whole 141 samples, eight were adulterated, but contained nothing absolutely prejudicial to health.

At the Hereford Quarter Sessions no report was presented from the County Analyst. Major Clive said he protested against this continued farce of paying an official for doing nothing. It was a waste of public money, and something should be done to put an end to such a state of things. He thought an analyst should be engaged as required. The Chairman (Sir Richard Harington) said they were unfortunately obliged to appoint an analyst, but if Major Clive would bring forward a proposal directed to getting rid of what he agreed was a farce, he was quite sure the Court would support him. The subject then dropped.

Mr. A. H. Allen, analyst for Sheffield, has presented the following report:—During the three months ending on the 31st March, I received from the inspector, and duly analysed and reported on, a total number of thirty samples of food, &c. Twelve samples of lard were all found to be genuine. This result is somewhat remarkable in the face of the fact that certain wholesale dealers have recently issued circulars offering advantageous terms to those purchasing watered lard. The explanation possibly lies in the fact of the inspectors being personally known to the vendors of the lard. Of six samples of butter five were genuine. The other sample contained very little, if any, real butter. It consisted of one of the butter substitues now so largely made from beef fat, and similar materials, and known in commerce by the names of "butterine," "oleomargarine," &c. There is no reason to suppose that these fictitious butters are unwholesome if carefully made; but they differ from true butter in several important respects. Of twelve samples of milk, six were genuine, or of fairly good quality; three were of suspiciously inferior quality, but not sufficiently bad to justify their positive condemnation as adulterated; two had been deprived of a considerable proportion of the cream or butter fat by skimming or analogous means; and one sample was adulterated with about one gallon of water to four gallons of original milk.

At Chelmsford Quarter Sessions, Mr. T. A. Pooley, the Public Analyst, reported as under:—At the date of my last report the analyses of ten samples remained uncompleted, and during the quarter I have

received and analysed ninety-five samples of food, so that 105 analyses have been completed; twelve more samples have been submitted and are now being analysed, but as the results are not yet complete, they will be referred to in my next report. The ninety-five samples included the following articles: Milk twenty-four samples, butter fourteen, bread nine, pepper eight, tea seven, gin seven, coffee six sugar six, mustard six, tapioca three, arrowroot two, sweets, whisky, and vinegar one each. Of these 60 samples came from the fourteen districts of the county, 24 from the metropolitan police district, 7 from the West Ham Local Board, and 4 from the Leyton Local Board. Of the total number of articles analysed, 86 or 81·9 per cent. were genuine, and 19 or 18·1 per cent. were adulterated. The adulterated samples included milk, butter, gin, mustard, pepper, and vinegar. Butter: Of fourteen samples analysed by me last quarter only two were adulterated. One sample contained no butter fat at all and was composed entirely of fats other than butter fat, while the other sample contained as much as 88 per cent. of foreign fats. These two samples, although submitted to me as "butter," were really not butter at all, but an article known in commerce as "butterine." I cannot say this article is absolutely injurious to health, but I am of opinion that it is far inferior to butter as an article of food. From the inspectors' report to me it appears that no proceedings have been taken in these two cases of adulterated or fictitious butter. Mustard: Two out of six samples analysed were adulterated, but the adulteration consisted simply in the admixture of wheaten meal. Pepper: Out of eight samples of this article I found only one adulterated, but this contained as much as 12 per cent. of sand. Vinegar: The single sample analysed was far below the usual strength, and I therefore certified to its being adulterated, but as there is no legal standard of strength for this article, I was unable to state the exact percentage of added water. Accompanying the report is a schedule showing in detail the results of the analyses. Of the ninety-five samples sent in and analysed during the quarter, eighteen were adulterated, and in ten cases proceedings before the magistrates have been instituted, but one of the cases has not yet been heard. In the other cases, one defendant was fined £5 and costs, four £2 each and the costs, and one £1 and the costs, for selling adulterated milk; one was fined £1 and costs for selling adulterated pepper, and two were fined 5s. each and the costs for selling adulterated mustard.

According to the report of the Devon County Analyst (Mr. A. Wynter Blyth), recently presented at the Quarter Sessions, thirty-nine samples had been submitted for analysis by the various inspectors, namely, one sample of tea, one of sugar, six of bread, one of gin, fifteen of milk, eleven of butter, and four of flour. Of these, six—or about 15 per cent.—were adulterated. Three samples of milk out of fifteen, all from Torquay, were adulterated with varying quantities of water from 12 to 30 per cent., and three samples of butter out of eleven were found to be in great part artificial.

The analyst for Cheshire, Mr. J. Carter Bell, has reported to Quarter Sessions that during the past three months twenty-three persons were proceeded against in the county under the Sale of Food and Drugs Act, of whom eighteen were fined and five dismissed. The 184 samples examined by him included four of tea, six of bread, five of vinegar, two of drugs, six of mustard, two of flour, two of oatcakes, one of oatmeal, three of pepper, eight of butter, six of lard, and nine of coffee. Of these, only four of coffee and one of butter were adulterated.

The Public Analyst at Gloucester.—At a special meeting of the Gloucester Town Council, the Finance and Estates Committee reported that a letter had been received from the Local Government Board suggesting that the Council should give directions for samples of food to be procured and submitted to the Public Analyst for analysis, and that the subject generally and the terms of the Public Analyst's appointment having been considered, they recommend that the Town Clerk be instructed to give the analyst notice for terminating his appointment, with the view to the question being generally reconsidered.

LAW REPORTS.

Milk Adulteration by a Farmer—Sample taken at a Railway Station:—

George Myers, farmer, Pondtail Farm, Warnham, near Horsham, Sussex, appeared to a summons taken out by Inspector Stevenson, for consigning to a milk dealer milk which was afterwards found to be adulterated. The defendant said he would plead guilty, but declared, whatever the adulteration, it

was without his knowledge or sanction. Mr. Marsden asked that the full penalty under the Act should be imposed. The defendant was a farmer in a good position, and the authorities had for a long time tried, especially after remarks which had fallen from the magistrates, to find out if statements so often made by defendants summoned under the Act were true, that they sold the milk as they received it from the country. He had full evidence in this case to show the conveyance of the milk direct from the defendant's farm to the railway station, and so on to Champion Hill Station, Camberwell, where it was consigned to Mr. West, a milk dealer. Inspector Stevenson handed in the certificate of Dr. Bernays, showing that the milk, of which witness took samples at Champion Hill Station, was adulterated to the extent of 18 per cent. of added water. The defendant said he could say no more in answer to the complaint, that he knew nothing whatever of water being added. Mr. W. H. Fullagar said he attended on behalf of Mr. West, to whom the milk was consigned. The defendant had undertaken to supply him with pure milk, but in consequence of complaints from customers, Mr. West had at once communicated with the authorities in order to find out how the adulteration was effected. Mr. Chance said it was highly important that such a thing should be traced if possible, as no doubt it came very hard upon those in the position of Mr. West, who might at any moment be summoned for selling adulterated milk, believing at the same time they had received it pure from the farmer. He ordered the defendant to pay the full penalty of £20, together with £3 costs.

Coffee and Chicory :—

James Spitty, grocer and tea-dealer, of High Street, Whitechapel, was charged with having sold coffee containing a mixture of chicory. The sanitary officer of Whitechapel it appeared sent a lad into the defendant's shop to purchase half a pound of coffee. The lad was asked by the assistant "What price?" and replied, "Shilling." The assistant then suggested "Mixture," and the lad said "Coffee." He paid 6d. for what he received, and gave it to the sanitary officer before leaving the shop. The analyst's certificate handed in showed the "coffee" to be adulterated with thirty-seven per cent. chicory. —The defendant said that he had been in the trade thirty years, and never knew pure coffee sold at 1s. a pound, and customers well knew that "shilling coffee" was a mixture.—Mr. Bushby said that, by the 8th Section of the Act, articles of food or drugs sold as "mixtures" were to be labelled as such. He would not assume a fraudulent intention, but could not inflict a less penalty than £5 and costs.

Summons dismissed because not taken out within reasonable time :—

Mr. Richard Gilbert, was summoned at Devizes, on Wednesday, for selling as mustard a compound which was not of the substance or nature it was represented to be. The certificate of Mr. Stoddart of Bristol, the Borough Analyst, was put in, showing the mustard to have been adulterated to the extent of not less than 60 per cent. with starch, and coloured with some foreign matter. For the defence it was elicited that the purchase was made on the 26th Dec. last, and the analysis was received on the 29th Dec. The summons was not issued until the 17th of March, and a technical objection was raised that this was not within "a reasonable time." The Bench sustained this objection, ruling that it was not fair to the defendant that so long a time should elapse. The case was accordingly dismissed.

Sweet Spirits of Nitre :—

At the Glossop (Derbyshire) Police Court, lately, the Compstall Co-operative Society was summoned for having sold 3ozs. of sweet spirits of nitre which was not of the quality demanded. Mr. James Harding, manager, appeared on behalf of the Society. Colonel Shortt, Deputy Chief-Constable, said that he called at the co-operative store and asked for 3ozs. of sweet spirit of nitre, for which he paid 1s. The analyst (Mr. Allen, of Sheffield) certified that the nitre was very deficient in real nitrous ether, and would have but little value as a remedy. The sample was also very deficient in alcohol, containing only 58½ per cent. of real alcohol, which corresponded to a dilution of sweet spirits of nitre of good quality with one measure of water. The dilution with water was the chief cause of the deficiency of nitrous ether, as adulterated samples decomposed in the course of several months. Mr. Harding said the Society did not meddle with the nitre, and it was sold precisely as they received it from the wholesale dealers. The magistrates observed that there was no defence, except they bought with a written warranty. They should only deal with men who could warrant the genuineness of the articles they sold. Fined £1 and costs.

Colman's Mustard—labelled "Mixture":—

At Jedburgh, Scotland, on the 13th of April, before Sheriff Russell, Messrs. David Cochrane, grocer, Midlem; Alexander Steele, grocer, Lilliesleaf; and James Edgar, grocer, Newcastleton, were charged, under the Food and Drugs Act, with having sold to Inspector Hoggarth certain quantities of Colman's mustard which was not of the nature or quality asked for, all of whom pleaded not guilty. Messrs. Colman determined to defend these cases, and instructed Messrs. Turnbull, Simson and Sturrock, solicitors, Jedburgh, to look after their interests, and they secured the services of Mr. Jameson, advocate, Edinburgh, to conduct the defence; and as these were test questions for Scotland, the Procurator-Fiscal employed Mr. Keir, advocate, Edinburgh, for the prosecution. For the convenience of the Court, all the cases were disposed of at one time.

Archibald Hoggarth, inspector of police and officer under the Act, deposed that he purchased the various samples at the shops of the accused, and handed them to the Public Analyst. In the two first cases he paid 6d. for the quarter-pound canister, each of which had a yellow label, and for the other he paid 5d., the label in this case being red. Cross-examined—In each I only asked for mustard; I did not ask for pure mustard. After I had bought the mustard from Edgar, and told him it was for analysis, he pointed out to me a notice on the side of the tin, "This is sold as a mixture of pure mustard, farina, and choice condiments." I expected to get pure mustard. I observe that the tins are of different shapes, and that two are marked "Double superfine," and the red is marked "Fine." I never bought double superfine for 5d. a quarter. My impression is that the loose mustard, as sold in grocers' shops, is pure.

Messrs. Falconer, King, F. Sutton, and T. W. Drinkwater, Public Analysts, gave evidence as to the composition of the mustard.

Robert Hazlewood deposed to being manager to Messrs. Colman at their works at Norwich. They employed nearly 2,000 people, and were the largest mustard manufacturers in the world. The objections to pure mustard were of two sorts. First, the grocers objected to it, as it would not keep more than perhaps three months without becoming lumpy, in consequence of the oil it contained. The oil, unless absorbed by some means, was apt to ferment and the mustard suffer as to flavour. The second objection came from the consumers. Mixed mustard when made up would keep for a week, while pure mustard would become dark and unpleasant to the sight in the course of twenty-four hours. Besides, the mixed was more palatable. The pure article had to be eaten with great care, otherwise it would cause uncomfortable sneezing, and its strength was apt to overpower the flavour of the meat. The firm sent to Scotland before the passing of the Act only about 6 per cent. of genuine mustard, but after the Act was passed it rose to 47 per cent. It had, however, gradually decreased, and now very little was sold except in bulk to be retailed in small quantities. This kind was of inferior quality, and sold at a cheap rate. The reason of sending out this kind was that grocers did not like the trouble of labelling small quantities, and were nothing but the best qualities sold the poorer classes would not be able to buy it. They did a large trade with Australia and America, and it would be impossible to send it to Australia in good order unless it was mixed, in consequence of the heat, as it had to cross the line. Mr. Colman always used the mixed at his table and as he had had the honour of entertaining the Prince of Wales to dinner, thee might be sure he would produce the best to him. The Government used the mixed for thy navy, but rice flour was put in that instead of wheat flour. All the different varieties were called mustard, and known to the trade as such. Every package is labelled, so that purchasers may know what they are getting. In some places in England nothing but mixed is sold. It is not as a matter of economy that the flour is used. The flour is of the finest quality, and very carefully prepared, and the purchaser of the mixed has as good value as he who buys the unmixed.

Mr. James Blair, wholesale grocer, Edinburgh, deposed—I do a large business in mustard. I have been in business for thirty years. During the whole of that time I have sold large quantities of Colman's mustard. Of late years we have had both mixed and pure. They go by the name of pure and condiment. After the passing of the Act I kept nothing but pure, which I found not satisfactory, as my trade was falling away. I had many complaints about it, and some was returned. It would not keep, but became lumpy and tasteless. I sell chiefly the condiment now. Unless asked for pure I always send mixed. It is the same to me. I sell a little of the pure cheap in 12lb. tins to retail out in small quantities. Customers ordering generally say if they want F. or D.S.F., and in ordering from Colman I ask for F., S.F., or D.S.F.

Mr. William Dickson, wholesale grocer, Edinburgh; and Mr. John Kay, of Messrs. Turnbull & Kay, Edinburgh, gave similar evidence, and several Jedburgh grocers gave similar evidence as to the custom in the retail trade.

After addresses from the counsel, Sheriff Russell said he had already carefully studied the Acts, and was prepared to give his judgment at once, which was one of dismissal. It was quite evident that when a customer asked for mustard he expected to get it mixed unless he asked for pure specially.

Each of the accused got £1 for expenses.

At Hammersmith, H. Aldridge, of Masbro' Road North, Hammersmith, appeared to answer an adjourned summons for selling adulterated milk to the inspector appointed under the Act. Mr. Jones, clerk of the District Board, supported the summons; and Mr. Farman appeared for the defendant. A sample of the milk had been sent to Somerset House to be analyzed, as Mr. Farman disputed the correctness of the Board's analysis. Mr. Jones said the certificate of the Board's analyst went to show that the milk contained 14 per cent. of added water. The certificate from Somerset House said the milk was adulterated with not less than 4 per cent. Mr. Farman said the certificate of Professor Redwood, who had also analyzed the milk, went to show that there was not any added water; it was poor milk. Mr. Paget said there had been failures in other cases. Therefore it was serious, as it threw doubt on the efficiency of the first examination. Mr. Jones said the difficulty arose through the want of a fixed standard. There was one at Somerset House, but it was not known to the analysts, who adopted different standards. Mr. Paget looked at the Act, and said he was not bound by the certificate from Somerset House. However, he dismissed the summons, and ordered the Board to pay six guineas costs.

RECENT CHEMICAL PATENTS.

The following specifications have been recently published, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

No. 1881	Name of Patentee.	Title of Patent.	Price.
3473	E. J. Harling & E. Hartmann	Electric Lamps	6d.
3517	C. Pieper	Treatment of Saccharine Juice	2d.
3728	E. Hagen	Production and Application of Ozonized Oxygen for Bleaching, &c.	6d.
3748	C. F. Clans	Manufacture of Hydrate of Strontia	4d.
3799	W. Crookes	Electric Lamps	6d.
3807	A. W. Gillman & S. Spencer	Drying Rice	6d.
3821	A. L. Fyfe	Electric Lamps or Regulators	6d.
3844	A. M. Clark	Manufacture of Salts of Magnesia and Salts of Zinc	4d.
3890	D. G. Fitzgerald	Electric Lamps	6d.
3930	W. P. Thompson	Manufacture or Purification of Albumen	4d.
3958	P. Jensen	Refining and Crystallizing Starch Sugar	4d.
3959	P. Jensen	Refining Starch Sugar	4d.
4017	S. Hallett	Electric Lamps	4d.
4024	W. Morgan Brown	Electric Lamps	2d.
4088	H. E. Newton	Treatment of Sewage and Refuse Matters	4d.
1882. 24	W. R. Lake	Removing Flocculent Matter from Spent Acids used in Treatment of Soluble Fibre	4d.

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; Journal of Applied Science; The Provisioner; The Practitioner; New Remedies; Proceedings of the American Chemical Society; Le Practicien; The Inventors' Record; New York Public Health; The Scientific American; Society of Arts Journal; Sanitary Engineer of New York; The Chemists' Journal; Oil and Drug News; Sugar Cane; Country Brewers' Gazette; The Medical Record; Oil and Drug Journal; The Canada Lancet; Gas and Water Engineering; The Grocers' Gazette; Columbia School of Mines Quarterly Magazine; Volumetric Analysis, by T. Sutton; Modern Metrology, by Lewis D'A. Jackson; Foods: Composition and Analysis, by A. W. Blyth (Griffin & Co., Exeter Street, Strand).

THE ANALYST.

JUNE, 1882.

SOCIETY OF PUBLIC ANALYSTS.

A General Meeting of this Society was held on the 31st May at Burlington House, Piccadilly; in the absence of the President, the chair was taken by Dr. Muter, Vice-President.

The minutes of the previous meeting were read and confirmed.

Dr. Bostock Hill and Mr. Hehner were appointed Scrutineers to examine the ballot papers, and reported that the following gentlemen had been elected members:—Mr. A. E. Ekins, Analytical Chemist, St. Albans; Mr. Bernhard Halford, Analytical Chemist, London; and Mr. W. H. Watson, Analytical Chemist, Bolton.

The following papers were then read and discussed:—

"On a Fat recently extensively offered as an Adulterant for Lard," by J. Muter, Ph.D., &c.

"On Discordant Milk Analyses," by F. P. Perkins, F.C.S.

"On the Composition of the Black Deposit which forms on the Electrolysis of Saturated Solution of Silver Nitrate," by J. W. Gatehouse, F.C.S.

The Next Meeting of the Society will be held on June 28th.

NOTE ON A FAT RECENTLY EXTENSIVELY OFFERED AS AN ADULTERANT FOR LARD.

By John Muter, Ph.D., F.I.C.

Read before the Society of Public Analysts, on 31st May, 1882.

This fat (of which I exhibit a specimen) is in some respects peculiar. It is, as you see, not at all unlike lard, being similar in consistence and general appearance. According to my analyses of several samples which I have had submitted to me by firms in the lard trade, anxious to know what it is, I find on an average the following result:—(1.) It has an actual density at 100° F. of ·911·5 to ·912. (2.) It yields on saponification 95·5 per cent. of fatty acids, all insoluble. (3.) It is completely soluble in ether and in hot absolute alcohol. (4.) When melted and treated by my modification of Chateau's course, it gives reactions for cotton oil. It is, therefore, evidently the "stearine" separated out during the rectification of that oil. A most striking fact is that, although nicely made to almost the exact consistence of lard at ordinary temperature, and not becoming perfectly

fluid under 90° F., yet, after melting, it does not again solidify, but remains a yellow having the distant odour of fine cotton salad oil, until it has been kept at 40° F. some time, when it again resumes its original appearance. Its detection in lard is happi rendered simple by its high density and by the article not setting so solid as it was at fi after having been kept melted for the purpose of taking gravity. If added to "butteri it makes the article softer and better looking in winter, and increases the density, b high insoluble acids then serve to distinguish such a "butterine" from a mixture of fat butter. Many recent "butterines," which on the density actually show a consid amount of pure butter, have not a trace, but the error is due to the presence of this "stearine."

REPORTS ON ADULTERATION IN THE STATE OF NEW YORK.

From the *Sanitary Engineer*, New York.

(Continued from page 88.*)*

Group II.

Butter:—Dairy and Artificial; Cheese; Lard; Olive Oil, and Fruit Essences.

Report by Prof. G. C. Caldwell, Ph.D., of Cornell University, Ithaca, N. Y.

BUTTER.

The adulteration of butter with cheaper fats was noticed by English chemists as early as 1861, "at present oleomargarine occupies the most prominent position as an adulterant of butter."

It is stated that the production of oleomargarine butter in this State amounts to 20,000,00 per annum, which is equal to one-fifth of the quantity of dairy butter made. Lard is sometimes for adulterating butter, but its use is much less extensive than that of oleomargarine. It also ap that certain vegetable oils, as that from cotton-seed, are sometimes employed.

Prof. Caldwell asks the question whether the addition of these cheaper fats to butter is an adul tion, since butter is only fats identically of the same character. The substitution of a cheaper more expensive article of food if it is sold as the latter, is a violation of the law. As to the w someness of oleomargarine, the question still remains open to discussion. In 1879 the English Government Board "declared that it could see no reason against the use of oleomargarine, pro that it be invariably sold under a distinctive name, and not fraudulently substituted for ge butter."

Earlier French official reports recognize oleomargarine as perfectly wholesome, but a later r expresses the opinion that its effect on the health is not good on account of the greater difficu digesting it. Opinions of private observers are cited, some of which are to the effect that a tissue, &c., are found in oleomargarine, while others assert that when carefully made these objec will be found to have no support.

Another form of adulteration which is sometimes practiced is the addition of water. B ordinarily contains from 5 to 10 per cent. of water, although some fix 18 per cent. as the maxi By careful manipulation, however, butter can be made to retain as high as 50 per cent. of water.

The methods of examination of butter are next considered, and are classified under five hea (*a*) tests by specific gravity, (*b*) tests by melting point, (*c*) tests by the microscope, (*d*) brief quali tests, (*e*) partial quantitative analyses.

The specific gravity test depends upon the fact that "fats generally used for the adulteration of butter have a lower specific gravity than that of pure butter fat." While the specific gravity of the latter ranges from 0·865 to 0·868 at 100° C., beef and mutton fat have a specific gravity of 0·860, and lard of 0·861. As to the use of this method it is "concluded that the test is not one upon which much reliance can be placed."

The fusing point test "depends for its usefulness on the fact that the melting point of butter is lower than that of many other fats with which it is commonly adulterated." The authorities do not agree as to what the fusing point of butter is, the differences being due to differences in manipulation, and Prof. Caldwell concludes that "one who would test butter for adulteration by the determination of its fusing point should fix upon his own standards of comparison, by many tests of his own of genuine butter and its adulterants, and of mixtures of them."

The microscope has been employed in the examination of butter to detect the crystalline structure of foreign fats, supposing that these fats have been melted in the process of manufacture. The polarizer is of much service in these examinations, but "little dependence can be placed on any microscopic test of the genuineness of butter, at least so far as the observation of crystalline forms of foreign fats is concerned, for neither does the absence of such forms prove that the butter does not contain oleomargarine nor does their presence prove the adulteration."

The general usefulness of qualitative tests, of which several are given, "is very questionable." "While most of them will answer well enough for distinguishing oleomargarine butter pure and simple, or a butter made from tallow, lard and oil," they fail to detect the presence of oleomargarine in genuine butter, even though it exists in considerable quantity.

The partial quantitative analyses "are the only ones that give positive and incontrovertible evidence" of adulteration of butter with foreign fats. Prof. Caldwell gives a very complete *resumé* of the various methods which have been suggested and to some extent employed in detecting this form of adulteration. One of the best of these methods is that devised by Hehner and Angell, which depends upon the separation and weighing of the insoluble fatty acids. These acids in genuine butter vary from 86·5 to 87·5 per cent., while beef and mutton fat and lard yield 95·5 per cent. There is considerable difference of opinion among chemists as to the exact limits to be fixed for the percentage of the fatty acids in genuine butter, some claiming that the figures given above are too high, while others consider them too low. Another process which has found much favor depends upon the distilling off of the soluble fatty acids and titrating the distillate. This method as modified by Reichert* was employed by Prof. Caldwell in his examination of butter. It consists in the saponification of the fat, the decomposition of the soap by acid, distilling and titrating a certain quantity of the distillate with a one-tenth normal alkaline solution. He employs in all cases "the same quantity of butter, of alkali for saponification, dissolved in the same quantity of alcohol, adding the same quantity of acid for decomposing the soap." It was found that 14 c.c. of this alkaline solution was required "to neutralize 50 c.c. of the distillate from the acids yielded by 2·5 grams of the filtered butter fat, while for oleomargarine only 0·95 c.c. af the alkaline solution was required, and for lard, 0·3 c.c. Reichert claims that 10 per cent. of foreign fats can be detected in this way, "and that when the distillate requires only 12·5 c.c. of the alkaline solution the butter may be considered as adulterated."

For the detection of water as an adulterant Prof. Caldwell employed a method suggested by Hoorn,† which consists in melting 10 grams of butter in a graduated tube with a narrower part at the lower end. The butter is then mixed with 30 c.c. of petroleum ether by shaking, after which the water separates in the narrow tube. Hoorn found that the water in good butter ranged from 12 to 14 per cent., and over 20 per cent. only in adulterated butter.

"The result is more reliable if the first etherial solution is decanted off and the residue is shaken up with a fresh quantity of the ether."

* Fres. Zeitschr, 18, 1879, 68. † Fres. Zeitschr, 11, 1872, 334.

Prof. Caldwell examined forty-two samples of butter, the results of which are given in the following table:

Inspector's No. of Sample.	Trade Designation.	C. C. of Alkali Solution Required.	Volume p'r cent. of Water, etc.
122a	Oleomargarine butter, procured at my request	* 1·5	
122b	Oleomargarine butter, procured at my request	* 1·7	
236	Dairy butter, costing lb. 29c	14·9	14·79
237	Dairy butter, costing lb. 30c	13·7	14·53
238	Cooking butter, costing lb. 18c	13·6	15·55
239	Dairy butter, costing lb. 25c	13·1	28·58
240	Best creamery, costing lb. 40c	13·5	15·21
241	Best dairy, costing lb. 44c	13·6	15·15
242	Best creamery, costing lb 38c		19·53
243	Good dairy, costing lb. 26c	14·	16·10
244	Fair dairy butter, costing lb. 20c	15·1	14·26
289	Butter, costing lb. 32c	* 1·	10·66
290	Butter, costing lb. 32c	1·3	15·22
291	Butter, costing lb. 20c	12·8	16·87
292	Butter, costing lb. 20c	* 1·6	13·79
293	Butter, costing lb. 22c	13·7	19·55
294	Butter, costing lb. 26c	* 1·6	10·80
295	Butter, costing lb. 26c	12·7	30·75
296	Butter, costing lb. 26c	15·3	11·17
297	Butter, costing lb. 24c	14·5	14·94
331	Dairy butter, costing lb. 28c	* 1·6	10·
332	Splendid dairy butter, costing lb. 30c	13·	14·79
333	Extra fine dairy, costing lb. 33c	13·8	12·32
334	Splendid dairy, costing lb. 30c	15·5	13·19
335	Creamery butter, costing lb. 32c	* 2·2	
336	Good dairy, costing lb. 30c	14·8	26·27
337	Roll butter, costing lb. 35c	* 1·8	7·74
338	Good creamery, costing lb. 28c	14·7	12·80
339	Fair table, costing lb. 25c	15·3	18·15
340	Dairy butter, costing lb. 30c	* 2·1	9·71
357	Genuine dairy, costing lb. 30c.	14·1	16·65
358	Roll butter, costing lb. 27c	* 2·7	9·62
366	Good dairy butter, costing lb. 30c	*10·2 *11·6 *11·4	15·56
2001	Butter, costing lb. 36c	12·8	15·
2002	Butter, costing lb. 26c	15·9	11·47
2003	Oleomargarine butter, acknowledged to the Inspector, costing lb. 26c	*	12·71
2004	Oleomargarine butter, acknowledged to the Inspector, costing lb. 26c	*	8·54
2005	Oleomargarine butter acknowledged to the Inspector, costing lb. 20c	*	11·52
2006	Butter, costing lb. 30c	15·5	28·82
2007	Butter, costing lb. 48c	14·9	16·16
3102	Best country butter, from my own table, costing lb. 32c	14·1	
3103	Best country butter, from my own table, costing lb. 32c	13·9	
2016	Western butter	14·4	10·45
2017	Butter, acknowledged by seller to be a mixture of lard and butter	* 5·4	13·27

Nos. 122a and 122b were oleomargarine, while 3102 and 3103 were genuine butter, these being taken to test the method of examination.

As 12·5 c.c. of alkali is the limit fixed in Germany, where the method is most used, it appears that No. 366 is a mixture of butter and oleomargarine. Those marked with an asterisk (*) contain fatty matter other than genuine butter.

No. 295 is adulterated with water and Nos. 239, 242, 292, 336 and 2006 are considered as suspicious.

The microscopic examinations on oleomargarine butters showed in one case indications of bac and in another of fungoid vegetation, and in several remains of tissue. These objects were occurrence, however, and it is not considered as "proved that some of them may not be found in butter of poor or ordinary quality with as much frequency." Prof. Caldwell is "not prepared to *their* occurence is characteristic of oleomargarine butter."

CHEESE.

er mentioning the possible adulterations of cheese as given by different authorities, Prof. Cald- tates that lard cheese has to a considerable extent supplanted that made from skimmed milk and argarine, which was largely manufactured some years ago. There are over twenty factories in this where lard cheese is manufactured, and an account is given of the method of manufacture. The heeses so closely resemble cream cheeses that experts are often deceived by them. It is stated he manufacture of lard cheese is confined to this State, and that for the six months ending November 1, 800,000 pounds were made by the twenty-three factories engaged in the business. Most, if not all, s cheese is exported.

less lard cheese is sold under its distinctive name, its sale must be considered as a fraud—first, se "it contains less fat and fat of a cheaper kind than the ordinary full-cream cheese," and dly, there are some grounds for the belief that the lard is less easily digested than butter fat.

speaking of skimmed milk cheese, Prof. Caldwell says it is doubtful whether such cheeses are any- sold in a way to deceive consumers as to their character. To prevent these cheeses from puffing r "huffing," as it is technically called, from the abnormal generation of gases in the interior before become fully ripe, patented "anti-huffing" extracts are employed. One which was examined con- of "caustic and carbonated alkali, saltpetre and a little annatto for colouring, dissolved in water," another was almost entirely borax.

oes not appear that any samples of cheese were submitted for examination, with the exception of hich was said to produce sickness. An examination of this sample, however, failed to reveal the nce of any poisonous substance, and Prof. Caldwell concludes that the injurious action was probably an "unknown organic substance resulting from an abnormal process of ripening."

LARD.

ious writers have stated that lard is frequently adulterated, and that of the adulterants employed, , starchy matters, salt, alum, lime, &c., are the most common. The detection of these substances atter of no difficulty. Prof. Caldwell examined twenty-eight samples, which varied greatly in colour, e and odour. Some had a texture reminding one of cotton, and emitted a disagreeable odour, which much worse when the samples were melted. Aside from the question of adulteration some of these could not be considered wholesome articles of food. Of the twenty-eight samples examined contained "no water," three had a "little water," while the rest contained water ranging from 1 per cent. Prof. Caldwell concludes "that the practice of watering lard prevails to some extent, no case did the proportion of water reach the high figures mentioned by some writers, and in no was the water alkaline."

OLIVE OIL.

ccording to all accounts olive oil appears to be one of the most largely and variously adulterated of bstances put upon our tables." "Poppy oil, cotton-seed oil, ground or peanut oil, sesame oil, ed oil, colza oil, and even coal oil are mentioned as being used for this adulteration."

here is no evidence that any of these adulterants are injurious to health, and their use is in ion of the law only in that a cheaper article is substituted for a dearer one with fraudulent intent." occurrence of poisonous metals such as copper and lead may be a more serious matter from a ry point of view, although the quantity of these metals that might be taken into the system in the ity of oil ordinarily consumed may be of small importance." Water and salts will not be taken up by l and consequently cannot be used as adulterants. "The detection of these adulterations, and ally the identification of the oil used as an adulterant, is beset with much difficulty," and there is ick and satisfactory way of detecting adulterations.

f. Caldwell then reviews under the following heads the various methods that have been suggested is purpose:—1st, methods based on specific gravity or solidifying point; 2nd, methods based on es in consistency produced by certain chemical agents; 3rd, methods based on changes in colour

produced by certain chemical agents; 4th, spectroscopic tests; 5th, miscellaneous tests. Each is considered by itself, and various authorities are quoted with reference to the different tests mentioned. On many of these methods very little dependence can be placed and they are of no value practically. Considering the difficulty attendant upon the detection of adulterations in olive oil, Prof. Caldwell expresses the opinion that the "simplest way to clear the path of all difficulties would be that which has been proposed in the case of milk, to declare that a good article of olive oil fit for sale at good prices shall stand certain tests."

Sixteen samples of olive oil were examined, the tests being based upon the action of various chemical reagents upon the oils. "To sum up the whole matter, while there may not be in the results of these tests positive proof of the presence of this or that foreign oil in particular, there is fully sufficient proof of adulteration of some kind." Of the sixteen samples, nine are considered as adulterated, one with sesame oil, four with cotton-seed oil, two with ground nut oil, and two with ground nut or cotton-seed oils, or possibly with both.

(To be continued).

COCOA.

It is not only the makers of certain kinds of coffee mixtures who are affected by Mr. Gladstone's recent Budget resolutions; the cocoa manufacturers are now somewhat concerned in regard to the matter. In order to show how they may be affected, we give the following clause from the Customs and Inland Revenue Bill:—"(1.) If any person shall keep for sale, or sell, or offer or expose for sale, any article or substance whatsoever prepared or manufactured for the purpose of being in imitation of or in any respect to resemble chicory, or coffee, or cocoa, or to serve as a substitute for chicory, or coffee, or cocoa, or which shall be alleged or intended so to be, or shall be mixed with or called by any name of chicory, or coffee, or cocoa, such article or substance, and any chicory, coffee, or cocoa with which it is mixed, shall be forfeited, and may be seized by any officer of Inland Revenue, and the person preparing, manufacturing, or selling the same, or in whose custody the same is found, shall incur a fine of one hundred pounds. (2.) Section five of the Act of the forty-third year of the reign of King George the Third, chapter one hundred and twenty-nine, is hereby repealed, save as respects the validity, invalidity, effect, or consequences of anything already done or suffered." We are informed that at a recent meeting of cocoa manufacturers it was decided to wait upon the Government in reference to the matter, and we trust that the result will be satisfactory.—*Grocer.*

REVIEWS.

Foods: their Composition and Analysis. By A. Wynter Blyth, M.R.C.S., F.C.S.

The literature of food analysis is fast becoming bulky, and to some extent tiresome. Just at the time when we are anxiously expecting the work, on which it is an open secret that Mr. Bell, of Somerset House, has been for some years engaged, we are confronted with a second edition of Mr. Blyth's compilation. The present volume is much more ambitious in tone than the former, as Mr. Blyth has divided his original work, which treated both of food and poisons, into two distinct books, so keeping the subjects separate. It is well known that Mr Blyth is a universalist in genius; but, in this work, he surpasses himself, for he is, in turn, a historian, a lawyer, an inventor of apparatus, an analyst, a literary collector, and a biologist. The book opens with a sketch of the history of adulteration, commencing w the well-worn specific gravity experiments of Archimedes on King Hiero's crown, a

250 years B.C., taking us through all recorded matter on the subject in England, France and Germany, down to the establishment of the Society of Public Analysts. This part occupies 46 pages, and the author himself, in his preface, states it to be the result of considerable labour and research, and hopes it will be found interesting. That it is so, from an antiquarian point of view, is certain, but whether it is altogether in its right place in what professes to be a manual of practical chemistry is open to doubt. Leaving his *role* of historian, the author then assumes his legal robes, and we have a complete digest of the present state of the law as regards adulteration. The Sale of Food and Drugs Act is taken section by section, commented on, and the illustrative cases given where disputed points have occurred, together with Mr. Blyth's own legal view of some points not yet decided. This part would be useful if published separately in a little pamphlet, for the use of the inspectors and the public. Concluding this part of the book, we have, in appendix form, both the English and American Acts, and extracts from Mr. Wigner's American prize essay, which has already been noticed in these columns. Leaving the legal, the author then turns to the working bench, and we have descriptions of Soxhlet's fat extractor, the micro-spectroscope, and the author's own apparatus for extracting with volatile liquids, for the estimation of carbonic acids, and his improved Lane-Fox vacuum pump. All are very ingenious and calculated to save time, and conduce to accuracy. Turning now to the body of the book, we find that, commencing with colouring matters which are very well and yet concisely treated, it passes to the estimation and analysis of the ash of organic substances generally, and then to sugars and starches. The polarization of sugar is described, and the starches are classified microscopically, both by Muter's and Vogel's systems. In part IV. we meet with milk, a subject in which the author revels, and to which he devotes nearly a hundred pages. He refers to it in the preface as a fairly complete monograph, and in this we not only agree with him, but we go the length of saying that it is, in some points, the most complete we have yet met with. It is on this point that analysts will be anxious to compare the author's conclusions with those of Mr. Bell, when we have them. Mr. Blyth adopts the standard of 9 per cent. "solids not fat," but considers even that to be too low. He also suggests that in milks, the watering of which may be a matter of doubt, the examination of the ash for sulphates and nitrites might give good confirmatory data, and states positively that the ash of genuine milk only contains the merest trace of the former, while the latter is never present at all. In referring to milk standards, however, the author seems to have overlooked the fact which is so strongly in the minds of analysts who have considered the matter in all its bearings, namely, that the actual amount of "solids not fat" found must depend to a certain extent on the method adopted in the drying and subsequent extraction, and therefore in laying down any hard and fast line, the method of working must be also rigorously defined and adhered to. Following milk, there are 20 pages devoted to butter, in which the processes are well described, and the limits of ·911 actual density at 100 and 89·5 insoluble fatty acids originally proposed by Dr. Muter in the first number of THE ANALYST are confirmed and adhered to. Next follow sections on tea, coffee, spices, wine, beer and alcoholic liquids, all carefully written, and including Gautier's full tables for detection of foreign colouring matters in wine. The book concludes with a chapter of about 40 pages devoted to the chemical and microscopical analysis of water, in which the process adopted by our society is fully explained. Dr. Frankland's process for organic

carbon and nitrogen, and Dupré's method for organic carbon are fully described. In discussing the interpretation of the analytical figures obtained, Mr. Wigner's valuation scale is adopted and its use illustrated by a diagram of the author's monthly analyses of the Grand Junction Company's water for 1881.

Having thus briefly run through the contents of Mr. Blyth's book, we think that we have said enough to show that although loaded here and there with much extraneous matter, it is yet one without which no Public Analyst's library can be said to be complete. Like most chemical books, however, we occasionally meet with misprints due to inefficient proof reading—a specially dangerous instance of this being seen on page 353, where the specific gravity of coffee decoction is given as 1000·5. The index is also very imperfect, as, while pretending to give both the names of the substances referred to, and those of the authors of the various processes quoted, it fails so lamentably in the latter respect as to give an opening for the remark by captious critics that the author had therein ignored the existence of several of his British contemporaries. It would be wiser in future editions not to adopt such a style of index unless it can be properly carried out.

Modern Metrology.

By Louis D'A. Jackson, pp. xx. and 449. London: Crosby, Lockwood & Co. 1882.

There is, one may almost venture to affirm, but a single defect in this book: and that defect is the absence of an index. Perusal of the table of contents, and casual dips into the several chapters into which this volume is divided, serve to show that Mr. Jackson has here offered to the commercial and to the scientific world a work of great erudition and great value. The labour in collecting, arranging, re-calculating, and verifying the values given in this volume must have been enormous. A glance at any of the tables will demonstrate this, for each measure is always followed by three equivalents—namely: the English commercial, the English scientific, and the French scientific equivalents. The book is divided into two parts: the first part dealing with metrical units, the second part metrical systems. The historical introductions to the several chapters—the comparison of standards (with reference especially to the conditions under which they were made and under which they can be compared), and the recommendation by Mr. Jackson of a new metrical system—all these important sections of the work before us must be studied in the book itself: it would be impossible to do justice to them in a brief notice. We commend the volume to the consideration of all chemists.

CORRESPONDENCE.

[The Editors are not responsible for the opinions of their Correspondents.]

MILK ANALYSIS.

To the Editor of "The Analyst."

Sir,—Three of the samples of milk which I examined last year were the milk of a single cow, well fed and in good condition. The following is the analysis of the milk:—

Total solids	8·83 per cent.
Ash	·94 ,,
Chlorine in Ash	·267 ,,
Fat	2·98
Solids not fat	6·05
Water	91·17

These results were confirmed both by Mr. Bell, of Somerset House, and Mr. Wigner.

Mr. Bell in his report upon it says that "if the solids not fat only are made the factor for determining the purity or otherwise of the milk, we should conclude that it contained not less than 25 per cent. of added water."

In another letter from Mr. Bell, he says "We have never found the mixed milk of a dairy to yield less than 8·5 per cent. of solids not fat, and only in very few instances out of several hundreds have we found the milk of individual cows to yield less than 8 per cent." He concludes by saying, "I am of opinion that whenever the solids not fat fall between 8 per cent. and the limit or standard of 9 per cent. adopted by the Society of Public Analysts, some enquiry as to the history of the sample should be made before proceedings are instituted."

In this I quite agree with him, and I make it a rule to enquire about the history of all samples of milk.

The following extract from a letter from the Secretary of the Local Government Board respecting the same sample of milk may also be of interest to other analysts :—"The analysts' certificate is not incontestable as proof of the commission of an offence, and it would be open to the person selling the milk to bring forward evidence that it had not been watered. It would then be for the magistrate to decide whether an offence had been committed against the Sale of Food and Drugs Act, by the sale to a purchaser asking for milk, of a sample far below the quality of the article commonly known under that name."

Yours, &c.,

W. F. LOWE, *Analyst for Chester.*

CHEESE ADULTERATION.

The following letter has appeared in the *Rugby Advertiser* :—

THE FARMER'S FRIEND.

SIR,—To the well-informed Secretary of the Cheshire Chamber of Agriculture the public is indebted for a few interesting facts about the American cheese trade. As your readers know, the competition between the American cheese factory and the British dairy is keen enough, even when conducted on legitimate and thoroughly honest grounds. But when to the facilities already possessed, are added all the roguery and cuteness that the Yankee can command, it will be admitted the chance of the British farmer to make a living is a small one. Through corresponding with a cheese retailer the Secretary has discovered how "prime American" is manufactured. Messrs Burrell & Whitmore have what they call "creameries," *i.e.*, cheese factories; and in response to an application from a London cheese dealer, sent him two cheeses, one made of lard the other of oleomargarine. The exporters were rather proud of their achievement. The cheeses had been "kept for some time," and had been successfully proved by experts, and were, in short, a triumph of the adulterator's art. No secret is made of the *modus operandi*. The makers in their circular openly say—

"You will be able to judge what can be done with the bluest kind of skimmed milk when treated with lard or with oleomargarine at the rate of 1½lbs. to the 100 of milk. You will be able also to compare the quality and flavour of the lard cheese with that made with oleomargarine. Four pounds and upwards of butter were taken from 100lbs. of milk before treating it with lard, and the same as to the specimen treated with oleomargarine."

It comes to this: that our dairy farmers are exposed to a new danger. Already has Sir Herbert Maxwell made an ineffectual appeal against the defrauding of the British dairyman by the introduction of oleomargarine butter: already has our Government preferred to feed the British sailor on American salt junk instead of upon good English meat; and now the cheese producer of Warwickshire who makes his cheese in an honest manner will find himself ousted from the market by the horrid concoctions of Yankee sharpers. Where is it to end? We Englishmen throw open our ports to them free while they shut theirs to us; we buy their produce in preference to our own, and we give them every possible legislative facility for hounding the British farmer—the backbone of the constitution— out of the market. No doubt we shall be told that if people like to buy congealed oleomargarine and lard for cheese they can do so; but how is the farmer to pay his rent if he can't sell his beef, butter, or cheese? When Carlyle said the world was made up of fools he must have had in his prophetic mind the accession to office of a Government such as the present one, which is bent on committing commercial and agricultural suicide. I have only to say that a Government which protects the importation of shamefully adulterated food, encourages unprincipled opponents instead of its own people, increases the farmer's burdens though it lessens his source of revenue, and yet calls itself "the farmer's friend," is a very Liberal Government indeed. In fact, none but a Liberal Government could do it.—Yours, &c.,

G. G. LAMBERT.

SOCIETY OF PUBLIC ANALYSTS.

Analyses of English Public Water Supplies in May, 1882. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Date when drawn.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine in Chlorides.	Phosphoric Acid in Phosphates.	Nitrogen in Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in: 15 mins. at 80° Fahr.	Oxygen, Absorbed in: 4 hours at 80° Fahr.	Hardness, Clark's Scale, in degrees: Before Boiling.	Hardness, Clark's Scale, in degrees: After Boiling.	Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
Kent Co.	May 24	c. p. blue	none	1·56	trace	·28	trace	·0017	·006	·026	20 0°	6·0°	27·6	satisfactory	Wigner & Harland.
New River	„ 13	c. faint yellow	none	1·12	trace	·19	·0021	·0028	·033	·067	14·0°	4·0°	19·6	satisfactory	B. Dyer.
East London ..	„ 13	yellow grn. clear	none	1·27	none	·19	·0036	·0052	·004	·026	14·0°	4·0°	22·4	vegetable debris, fibres	Wigner & Harland.
Southwark & Vauxhall ..	„ 7	c. pale yellow	none	1·24	trace	·11	·0007	·0070	·040	·072	14·5°	4·0°	21·7	none	John Muter.
West Middlesex	„ 22	very yellow	none	1·01	h. trace	·11	·0013	·0061	·030	·088	12·5°	3·0°	18·9	none	O. Hehner.
Grand Junction	„	p. yellow	none	1·15	trace	·09	·0028	·0047	·018	·096	13·4°	3·1°	19·7		A. Wynter-Blyth.
Lambeth	„ 7	c. pale yellow	none	1·24	trace	·12	·0007	·0070	·037	·061	14·5°	4·5°	21·9	none	John Muter.
Chelsea	„ 22	c. strong g. yell.	none	1·11	trace	·10	·0014	·0076	·020	·058	16·5°	5·0°	19·3		A. Dupré.
Birmingham ..	May 8	turbid greenish	none	1·26	trace	·16	·0021		·019	·071	10·5°	5·6°	18·6	vegetable matter	A. Hill.
Bolton	„ 1	clear	none	·40	none	·03	·0025	·0028	·010	·028	3·2°	3·0°			W. H. Watson.
Brighton	„ 8	yellow blue clear	slight	2·05	slight	·28	·0151	·0178	trace	·146	12·4°	·4°	22·8	vegetable debris	Wigner & Harland.
Bristol	„ 8	grnsh. brown	none	·91	none	·04	·0005	·0040	·017	·047	15·2°	2·5°	19·2	sand, algæ	F. W. Stoddart.
Cambridge	„ 16	c. p. blue	none	1·40	trace	·40	none	·0028	none	·008	17·5°	5·0°	25·0	satisfactory	J. West Knights.
Croydon	„ 21	c. colourless	none	1·19	h. trace	·23	none	·0025	none	·004	15·5°	6·0°	22·0	none	C. Heisch.
Darlington	„ 11	s. turb. yel. grn.	s. weedy	·63	trace	·03	trace	·0042	·141	·231	7·0°	5·0°	8·4	satisfactory	W. F. K. Stock.
Dublin	Apr. 29	clear	none	·86	trace	trace	·0020	·0055	·058	·200	1·3°	·6°	4·3	satisfactory	C. A. Cameron.
Exeter	May 9	f. brnsh. yellow	none	·91	trace	·15	·0014	·0042	·024	·047	2·8°	2·8°	6·3		F. P. Perkins.
Grantham	„ 14	c. p. blue	none	1·09	trace	·58	·0007	·0005	·003	·005	15·7°	5·3°	23·3	satisfactory	A. Ashby.
Hastings	„ 15	p. blue, s. cloudy	none	4·90	trace	·14	·0007	·0035	·004	·012	10·0°	6·0°	25·0	satisfactory	H. F. Cheshire.
King's Lynn ..	„ 15	light brown	weedy	1·64	trace	·17	none	·0080	·076	·487	13·5°	5·0°	17·6	diats., veg. debris, bact.	W. Johnstone.
Liverpool	„ 19	yell. green	s. peaty	1·02	traces	·35	·0014	·0042	·026	·085	3·7°	3·4°	7·84		A. Smetham.

SOCIETY OF PUBLIC ANALYSTS.

Analyses of English Public Water Supplies in May, 1882. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Date when drawn.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine in Chlorides.	Phosphoric Acid in Phosphates.	Nitrogen in Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in		Hardness, Clark's Scale, in degrees.		Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	Analysts.
									15 mins. at 80° Fahr.	4 hours at 80° Fahr.	Before Boiling.	After Boiling.			
Maidstone—															
Wtr. Company	May 13	pale green	none	2·50	trace	·51		·0014	·022	·067	17·7°	6·5°	33·6	none	M. A. Adams.
Public Conduit	„ 13	p. blue	none	2·28	trace	·51		·0007	·028	·058	15·8°	6·0°	32·3	none	M. A. Adams.
Manchester ..	„ 17	s. yell. clear	none	·62	none	none	·0027	·0030	·027	·060	1·7°	1·6°	4·6	satisfactory	William Thomson.
Newark	„ 17	c. p. blue	none	1·12	trace	·04	·0007	·0029	·004	·023	22·2°	13·3°	34·6	satisfactory	A. Ashby.
Newcastle-on-Tyne......	„ 18	ft. yellow	none	·88	trace	·04	·0010	·0080	·058	·101	14·3°	5·0°	18·6	satisfactory	J. Pattinson.
Nottingham ..	„ 18	green blue clear	none	1·49	none	·91	·0053	·0039	·006	·012	11·2°	5·0°	19·0	veg. deb., fibres, anml.	Wigner & Harland.
Norwich	„ 13	p. grnsh. yell.	none	1·70	trace	·08	trace	·0102	·052	·102	14·0°	4·1°	19·6		W. G. Crook.
Portsmouth ..	„ 10	clear	none	1·25	trace	·18	trace	·0063	none	none	13·4°	3·2°	12·5	veg. matter, diatoms	W. J. Sykes.
Rugby	„ 7	c. p. yellow	none	1·12	h. trace	·19	·0070	·0189	·039	·084	13·0°	7·5°	21·0	veg. deb., mvg. orgsms.	A. P. Smith.
Salford	„ 2	clear but yellow	none	0·60	none	none	·0007	·0014	·002	·034	3·5°	3·0°	4·5	none	J. Carter Bell.
Shrewsbury ..	„ 9	c. colourless	none	1·40	none	·26	·0008	·0045	·007	·007	21·0°	5·5°	25·0	none	T. P. Blunt.
Southampton ..	„ 21	p. y. rather turb.	none	·98	s. trace	·34	trace	·0071	·028	·072	15·0°	4·9°	20·3	diams. rotifers tardigrada	A. Angell.
Swansea	„	clear	none	1·00	trace	none	·0010	·0042	·003	·003	1·4°	1·4°	3·7	none	W. Morgan.
Whitehaven ..	„ 9	c. f. green	none	·47	trace	·01	none	·0008	·005	·012	·4°	·4°	2·1	satisfactory	A. Kitchin.

Abbreviations:—c., clear; f., faint; h., heavy; p., pale; v. h., very heavy; v. s., very slight.

ERRATA.—In the Manchester Water for April, the Chlorine should read ·745, not 7·45.

ANALYST'S REPORT.

At the quarterly meeting of the Bristol Town Council, recently, the Watch Committee presented a report, in which they stated that they had appointed eight inspectors of police—viz., two from each division of the police force—to perform the duties previously undertaken by the Inspector of Nuisances under the Sale of Food and Drugs Act, 1875; and the Committee submitted for the information of the Council a statement of the proceedings under the Act from June last to March 31st in this year. The inspectors had purchased and submitted to the analyst 198 samples, of which there were fifteen of coffee, eleven of mustard, eleven of butter, five of pepper, five of tea, two of sugar, one of cheese, and one of vinegar. In consequence of the analyst's reports upon these samples the Committee directed vendors of mustard, coffee, and butter to be prosecuted, and convictions were obtained in one case of coffee and one case of butter. In one case of mustard the summons was dismissed. Mr. F. Wallis Stoddart, the city analyst, presented his report for the quarter, in which he said thirty-one samples had been examined by him, and twelve condemned as adulterated or unfit for consumption. Out of samples of butter, one contained 75 per cent. of foreign fats, and that was sent in by the public; another forwarded by the inspector consisted entirely of other fats than butter. There were seven samples of butter genuine; two samples of pepper were genuine; six samples of mustard were genuine; one sample of vinegar was genuine; seven samples of coffee were genuine, and one sample was adulterated with 40 per cent. of chicory; five samples of tea were genuine; one sample of cheese was genuine.

LAW REPORTS.

Selling Butterine:—

On May 18th, before Sheriff Barclay, James King, grocer, 124, High Street, and residing at York Place, Perth, was charged, at the instance of Mr. John Welsh, superintendent of police, with selling on 22nd March last, to Sergeant Buist, city police, a pound of a compound of fat, in place of a pound of salted butter, which compound was not of the nature, substance, and quality of that demanded and paid for. Mr. Chalmers, solicitor, appeared in behalf of the accused, who pleaded not guilty to the charge. His defence he stated was, that it was "butterine" which was understood to be wanted and that it was not salt butter which was asked for. For the prosecution, Sergeant Buist, city police, was examined. He deponed that on the 22nd March he went into Mr. King's shop and asked for a lb. of salt butter. He paid 1s. for it. After buying it he told the seller, Miss King, that it was to be sent to the Public Analyst for analysis. He divided the butter into three parts, leaving a portion of it with Miss King. Cross-examined by Mr. Chalmers, witness said that he asked for one pound of salt butter. He did not ask for "a pound of their shilling butter." He did not expect to get "butterine" when he asked for salt butter. He had no reason to suspect or know that Mr. King sold "butterine." He did not know that people who made a practice of purchasing "butterine" called it shilling butter. He had frequently bought good salt butter at one shilling a pound. By Mr. Chalmers—Miss King did not tell him that it was "butterine" till after he had got and paid for the butter. By the Sheriff—After he had paid for it and told her that it was for the Public Analyst, she said it was "butterine," and that she would take it back. Witness would not agree to that. Miss King did not offer him good butter in place of the "butterine." Dr. Wallace, Public Analyst for the city of Perth and Glasgow, was examined. His analysis of the sample of butter bought by Sergeant Buist was as follows:—I am of opinion that it contains no butter fat, or at least no appreciable quantity, but is composed of fat other than that of butter, together with a small quantity of salt, a little of curdy or insoluble organic matter, and some water. No change had taken place in the constitution of the article that would interfere with the analysis. As witness my hand this 3rd day of April, 1882.—WILLIAM WALLACE. Dr. Wallace stated that the butter was transmitted to him in a sealed canister similar to the one produced in the Court. He considered that if a person went into a shop and asked for salt butter, and got in its stead an article such as he had analysed, he would be getting a different article altogether from what had been asked for. Cross-examined—The sample which he analysed had the same appearance as "butterine." He believed butterine was quite wholesome. It was composed of animal fat. The butterine he analysed was a good quality of "butterine." If witness had the choice he would rather take fresh "butterine" than rancid butter. The sample was opened on the day which witness received it. By the Sheriff—"Butterine" was manufactured chiefly in America. It was not worth 1s. a pound. The price of salt butter varied from about 10d. to 1s. 4d. or 1s. 5d., depending on the quality and the season. "Butterine"

was not invariably sold cheaper than butter. He supposed the dealer had a much larger profit on butterine than on butter. After evidence had been given for the defendant, Sheriff Barclay said that the only difficulty he had was in regard to the reprehensibility of the accused in having a placard in his window stating only that the price was a shilling, and not that the article was "butterine." One shilling being the price of "butterine," and not the price of salted butter, he did not think he could by any possibility convict, and therefore he dismissed the accused.

Colman's Mustard:—

At the Bedford Borough Police Court, recently, Mr. Wm. Henry Humphrey, grocer, Princes Street, was charged with selling adulterated mustard to George Steers, Sanitary Inspector of the Borough of Bedford, on April 4. Mr. Cockerell, barrister, Midland Circuit, prosecuted; Mr. Clare (Conquest and Clare, Bedford) defended. George Steers proved the purchase of the sample. Dr. Prior, Public Analyst of the borough of Bedford, sworn, said the certificate produced contained a correct account of his analysis of the mustard, sample No. 36. The certificate gave the proportion 80 per cent. of mustard flour, 19 per cent. of wheaten flour, and 1 per cent. of colouring matter. Cross-examined: I received one box of mustard from the inspector. I examined the sample with a microscope and also chemically. In testing it with iodine I found evidence of the presence of a large quantity of starch. I observed globules of oil with the microscope. I have heard of ether being employed in these analyses, but I am not aware that the ether process is in use at Somerset House. I believe the mustard in the sample was flour of the white mustard-seed. There may have been black with it. The seed is not very different, there is a slight difference in colour. I cannot perceive any difference in the smell. (A sample bottle of both white and brown mustard was produced.) I do not know the difference in the price of the brown and white seed. I do not know there is any difference in the quantity of oil produced by the two kinds of seed. I am aware that the oil varies in different qualities of seed. I am quite sure there was about 1 per cent. of colouring matter. I conceive that the sample of mustard was adulterated to render the production cheaper. I do not know whether it would be cheaper than the pure mustard. I did not know that pure mustard could be got at 10d. per lb. Mr. Clare then read an extract from *Gray's Pharmacopœia*, which stated that the mustard of commerce consists of mustard flour, wheaten flour, cayenne pepper, and is coloured with turmeric. The Witness said: I was not aware of that. The majority of samples that I have analysed have contained wheat flour and colouring ingredients, but some are pure, as one bought on the same day as this. The flour of mustard present was 80 per cent.; that was the estimate I arrived at. Re-examined: One of the samples brought to me on this day was perfectly pure. All the samples were submitted as pure. Mr. Clare having addressed the Bench, Mr. Francis Sutton, sworn, said: I am a Fellow of the Chemical Society, and also of the Chemical Institute. I was a witness before the Select Committee of the House before the Adulteration Act was passed. I am County Analyst for Norfolk, Borough Analyst for Yarmouth and also for Thetford, and I am the author of a standard work on chemical analysis. I have examined the sample of mustard left with the defendant by the inspector, and find 92·04 per cent. of the mixed flours of white and brown mustard-seed, 7·66 per cent. of wheaten flour, and ·3 of turmeric, colouring matter. About half of each kind of mustard seed was present. The brown seed is much stronger, while the white seed gives from 40 to 50 per cent. more flour. The white is the cheaper seed. The husks of the seed could be ground up and mixed with the flour, and would be simply pure mustard as required by the Act. The brown seed contains most oil. The quantity of the oil varies with the years; some years the crops are better than in others. White seeds go down to 23 or 24 per cent. of oil, and brown up to 43 per cent. That is the fixed oil from which when analysing I estimate the quality of pure mustard. I do not consider examination by the microscope and testing by iodine a complete analysis. Iodine would show the presence of starch, but not the quantity. The proper method is to take a weighed quantity of mustard, to extract the fixed oil, and to weigh that and from it calculate the quantity of real mustard. That is the acknowledged method. I consider it essential to a quantitive analysis to weigh the samples. The wheat flour mixed with the mustard absorbs the fixed oil, and prevents fermentation. The mustard I examined was of the finest quality. A grocer could not depend on keeping flour of white and brown mustard seed, unmixed with wheaten flour, good for three months. It would not keep crossing the line to the tropics, and it would not be fit for carriage. The mixture of wheaten flour improves the mustard, and removes the peculiarly bitter taste of the pure seed. The taste of pure mustard is disagreeable. The application of pure mustard to the skin would be a very powerful blister. The aromatic principle of the mustard is preserved by the mixture. The

turmeric is not injurious to health. For my own table I should prefer mustard from this sample to pure mustard. Cross-examined: The mustard is a mixture, and I should prefer that mixture to a pure mustard for table purposes. I did not find cayenne pepper present. Mr. Robert Haslewood, assistant manager of Messrs. Colman's mustard factory, Norwich, said: Wheaten flour is used in making the double superfine quality of our mustard, and it is the best quality of table mustard. The sale of this mustard greatly preponderates over the sale of the pure mustard. We cannot send the pure mustard to the tropics. If a grocer inadvertently put a few tins of pure mustard in his window in the sun it would get lumpy and ferment. It is no unfrequent occurrence for us to have tins of pure mustard returned on that account. We could not sell pure mustard except in the North, amongst miners and those sort of people. The husks could be ground up in the mustard, and it is done by some firms. We sell them from ¼d. to ½d. per lb. for manure. It would be a source of great profit to us if we did grind them in, but it would spoil our reputation and future sale. We can supply pure mustard at 10d. per lb.—that would consist entirely of the flour of white mustard seed and husks. We could not supply the mixture of mustard seed flour and wheaten flour any cheaper than the flour of pure mustard. They cost the manufacturer the same. We supply it at, I think, 1s. 5d. per lb. Prior to the passing of the Act only an infinitesimal quantity of pure mustard was sold. Mr. Charles Berwick, wholesale grocer and provision dealer, Greyfriars Walk, deposed to supplying defendant's father with Colman's mustard. At this juncture Mr. Cockerell said after the facts that had come to light during this examination he felt sure those who had instructed him would not wish to continue the case, and he therefore felt that he ought to withdraw it. The magistrates immediately took this view and dismissed the case, allowing costs of £4 4s. to defendant.

Heavy Fine for selling Butterine:—

At the Chippenham Borough Petty Session, recently, before Mr. H. Prodgers (chairman), Lord Dangan, Messrs. R. Walmesbury, A. B. Rooke, and G. L. Lopes, Mr. Clement E. Palser, grocer, of Burton-on-Nettleton, was summoned for selling to A. Barrett, superintendent of police, a certain article of food called butter which was not of the nature, substance, and quality of the article demanded. Superintendent Barrett proved that he purchased ½ lb. of butter from an assistant to the defendant, who stated that it was pure. He forwarded a portion of the article to Dr. Donkin, County Analyst, and he certified it to contain 80 per cent. of foreign fat and a little real butter. Mr. F. H. Phillips, on behalf of the defendant, admitted that the article sold was butterine, but said that the assistant was mistaken in telling Superintendent Barrett it was pure butter. The magistrates fined the defendant £10, to include costs.

Adulterated Coffee:—

At Stockport, before the Borough Bench, viz., Mr. W. Rayner, M.D., and Mr. W. Bale, surgeon, John Turner, wholesale and retail grocer, having several places of business in the town, and a member of the Town Council, was charged with having, on the 13th of April sold to the prejudice of the purchaser an article of food—viz., coffee—not of the substance, nature, and quality demanded. Mr. Dobson from the office of the Town Clerk, prosecuted on behalf of the Corporation; and Mr. F. Newton, solicitor, appeared on behalf of Mr. Turner, and pleaded not guilty. Peter Bradburn, a labouring man in the employ of the Corporation, said that on April 13th he went with Sanitary Inspectors Marshall and Craig to Mr. Turner's shop at 68, Great Portwood Street. Inspector Marshall told him to go into the shop and buy half a pound of coffee, and gave him the money to do so. The inspectors remained outside and witness went to purchase the coffee. There was a man in the shop. Witness asked the price of coffee. The shopman replied that there were different prices—1s., 1s. 6d., and 1s. 8d. per lb. Witness then asked for half a pound of coffee at 1s. The shopman gave him a parcel, and witness paid 6d. for it. There was no label pointed out to witness, and no conversation took place as to the contents of the parcel. Witness was going out of the shop when he was met at the door by Inspector Marshall, and that officer returned with him to the counter. The shopman then said he had told Bradburn it was not genuine coffee, but afterwards he admitted that he did not say so. Inspector Marshall deposed to dividing the mixture into parts as required by the Act, leaving one portion with the shopman and taking another portion to Mr. Oswald Wilkinson, the Borough Analyst. He examined the packet, and could not find anything outside to indicate that it contained a mixture. After the coffee had been taken out of

TABULATED STATEMENT SHOWING THE WORK DONE BY PUBLIC ANALYSTS, UNDER THE SALE OF FOOD AND DRUGS ACT, DURING THE YEAR 1881.

Compiled specially for THE ANALYST.

"	Carmarthen (Boro')	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	" (County)	8	1	..	..	4	..	..	..	1	1	2	..	..	..	..	..	15	2
"	Glamorgan	2	..	..	..	..	..	..	..	11	9	..	..	..	..	..	..	13	9
"	Haverfordwest	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Neath	3	..	..	..	3	2	..	..	..	..	..	..	..	..	..	..	6	2
"	Pembroke	5	3	..	..	..	..	..	..	20	4	..	..	..	..	..	..	25	7
"	Swansea	209	8	6	1	86	3	..	..	16	5	9	..	..	..	4	..	330	17
"	Tenby	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
E. H. Moore	Arundel	..	..	..	..	..	..	..	..	..	..	..	..	3	..	..	..	..	..
"	Brighton	130	23	18	2	42	3	18	..	24	5	28	..	14	..	5	..	279	33
"	Chichester	4	..	..	..	..	..	..	..	..	..	..	..	7	..	..	..	11	..
"	Sussex, E. & W.	40	13	25	4	21	..	3	1	18	3	10	..	62	..	3	..	182	21
J. Muter	Bermondsey	30	16	13	7	26	12	..	..	..	..	13	..	..	..	..	5	87	35
"	Lambeth	152	17	8	6	49	2	1	..	17	2	18	..	10	3	34	2	289	32
"	Newington	9	2	..	..	..	..	..	..	..	..	1	..	1	..	..	..	11	2
"	St. George's, Southwark	20	8	11	2	4	2	..	..	7	2	12	1	..	..	3	..	57	15
"	Tenterden	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
J. W. Thomas	Cardiff	89	1	9	..	31	1	..	..	3	3	6	..	..	..	10	..	118	11
"	Glamorgan	6	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	6	1
"	Monmouth	..	..	..	..	2	..	..	..	..	..	..	..	..	..	..	..	2	..
"	Newport, Mon.	46	2	2	..	5	1	..	..	2	..	1	..	..	..	2	..	58	3
C. R. C. Tichborne	Longford	4	2	2	..	1	..	..	..	9	5	..	..	17	12	..	..	33	19
J. Tripe	Hackney	73	17	5	..	21	3	5	2	8	..	2	..	..	..	6	..	120	22
F. Vacher	Birkenhead	38	10	1	..	2	1	..	..	1	..	..	..	13	5	1	..	56	16
T. H. Walker	Carlisle	4	1	..	..	4	2	4	1	3	..	..	..	8	6	..	..	23	10
W. Wallace	Ayr	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Perth	21	9	3	..	..	..	..	..	..	..	..	..	..	..	..	..	24	9
Wallace, Tatlock, and Clark	Glasgow	18	7	..	..	12	4	8	1	7	1	3	..	..	..	12	1	60	14
"	Johnstone	4	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	4	1
"	Kilmarnock	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Lanark (County)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Renfrew "	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Rutherglen	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Sutherland (County)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
G. W. Wigner	Greenwich	41	16	14	1	89	6	2	..	24	3	18	2	..	..	4	..	192	28
"	Plumstead	65	9	34	..	17	..	..	..	3	..	8	..	..	..	..	..	127	9
"	Woolwich	46	32	6	..	31	1	5	2	10	..	4	..	..	..	1	..	103	35
T. Woods	Parsonstown	..	..	..	..	..	..	..	..	..	..	..	..	5	..	4	..	9	..
	Total	6821	1361	1081	137	4328	420	487	93	1967	471	1134	48	1463	383	580	29	17808	2960

* Second half of year.

the paper, he observed near the edge a printed notice to the effect that it was a mixture. Witness produced the analyst's certificate showing there was an admixture of 49 per cent. of chicory. Mr. Newton proceeded to cross-examine the inspector, when Dr. Rayner observed that it was the public who were prejudiced by having this mixture sold as coffee. Coffee was a very important article of diet, and it was necessary that the public should be able to get it pure. Supposing anybody wanted a strong decoction of coffee, as they sometimes did, it could not be produced from an article like this. Mr. Newton: You surely would not purchase 1s. coffee for that purpose? Dr. Rayner: If I asked for coffee I should expect to get coffee. For myself, I would take good care not to buy coffee that was ground at the shop; I would grind it myself. The paper in which the coffee was wrapped had upon it a representation of Portstown, Jamaica, with a description of the place underneath, then the name of Mr. Turner, and at the bottom this notice—"This is an admixture in which no injurious ingredient has been used—38 and 39 Vic., cap. 63, s. 3." Inspector Marshall produced a second parcel, purchased at the same shop, wrapped as was the parcel bought by Bradburn, the notice being hidden. Mr. Newton ged that the notice printed on the paper was intended to comply with the Act, and in the face of such ntention he trusted that the Bench might not feel called upon to inflict a penalty. There was no allegation that Mr. Turner had increased the bulk for the purpose of obtaining a price to which he was not entitled. Mr. Dobson said there was no allegation of a felonious intent; and the magistrates also said they did not for a moment believe that Mr. Turner intended anything of the kind. Mr. Turner then gave evidence. He said the paper in which the coffee was sold he had purposely had printed in order to comply with the Act, and he was told by the printers that legal opinion had been taken upon it, and that it was sufficient. In addition to this he told his assistants to inform customers when they purchased the 1s. article, that it was not pure coffee, as it could not be bought at the price. The coffee of which this was a mixture was a fine plantation coffee—for he never bought anything which was inferior—and with the chicory it was a much better drink than coffee exclusively. Mr. Newton said he was prepared with an independent witness as to the marketable value of the article sold. The magistrate's clerk replied that evidence upon that point was unnecessary, as the marketable value was admitted. Dr. Rayner: Can you dispute the analyst's certificate? Mr. Newton: No. Dr. Rayner said that the public, in purchasing coffee, would be taken in by getting an article which was afterwards found to be half chicory. The case was clearly proved, and the defendant would be fined £3 and costs. He would advise people to buy coffee not ground, and grind it for themselves. So long as all sorts of things were put in, they did not know what they bought. Mr. Newton stated that Mr. Turner had requested him to give notice of appeal.

THE WORK DONE DURING 1881 UNDER THE SALE OF FOOD ACT.

We had hoped to have been able to publish in this number the remarks to which an examination of the accompanying tabulated statement give rise, but as some of the returns have only been received at the very last moment, we cannot do more at present than print the table, and will refer to the subject again next month.

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; Journal of Applied Science; The Provisioner; The Practitioner; New Remedies; Proceedings of the American Chemical Society; Le Practicien; The Inventors' Record; New York Public Health; The Scientific American; Society of Arts Journal; Sanitary Engineer of New York; The Chemists' Journal; Oil and Drug News; Sugar Cane; Country Brewers' Gazette; The Medical Record: Oil and Drug Journal; The Canada Lancet; Gas and Water Engineering; The Grocers' Gazette; Columbia School of Mines Quarterly Magazine; London Water Supply, by Crookes, Odling and Tyid; Annular Report of the Commissioner of Agriculture for 1880, Washington; Spon's Encyclopædia of Industrial Arts, Division V.; Journal of Society of Chemical Industry; Analysis of Potable Water, by Folkard; Catalogue of the Literature of the Chemistry of Food and Drugs, by A. L. Colby; Annular Report on the Sanitary Condition of Leicester; Report on the Temperature of Fresh Water Lakes, and Remarks on the Tastes and Odours of Surface Waters, by Professor Ripley Nichols; Public Water Supplies of West Cumberland, by A. Kitchin, F.I.C.

RECENT CHEMICAL PATENTS.

The following specifications have been recently published, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

No. 1881	Name of Patentee.	Title of Patent.	Price.
3976	P. Jensen	Electric Arc Lamps	6d.
4133	L. T. Wright	Purification of Gas	2d.
4174	E. G. Brewer	Electric Lamps	8d.
4193	C. H. Ginningham	Electric Lamps	4d.
4195	C. J. Davidson	Compound for Coating Iron, to Prevent Rust	4d.
4201	E. A. Parnell	Manufacture of Oxide of Iron	2d.
4202	J. W. Swan	Incandescent Electric Lamps	4d.
4214	H. E. Newton	Treating Seaweed to obtain Useful Products	4d.
4241	A. W. Reddie	Manufacture and Re-burning Bone Black	6d.
4250	E. P. Alexander	Separating Gases from each other	8d.
4251	F. Versmann	Manufacture of Floorcloth	2d.
4281	F. Wirth	Production of Magnesia and Hydrochloric Acids from Chloride of Magnesium	2d.
4305	H. J. Haddan	Electric Lamps	2d.
4310	A. P. Laurie	Secondary Batteries	4d.
4311	J. H. Johnson	Electric Lamps	6d.
4360	F. N. Mackay	Manufacture of Snow	6d.
4366	W. and H. Marriott	Treating Nitrogenous Substances to obtain Ammonia Therefrom	6d.
4396	J. James and J. C. Lee	Carbons for Electric Lamps	2d.
4397	T. Twynam	Manufacture of Magnesia	4d.
4398	A. W. Reddie	Secondary Batteries, or Electrical Accumulators	2d.
4405	A. M. Clark	Producing the Electric Light	10d.
4418	R. Mackenzie	Calcining Sulphide Ores of Copper and other Metals	6d.
4439	J. Jameson	Incandescent Electric Lamps	6d.
4441	J. Deucker	Recovering Nitric, Sulphuric and Muriatic Acids from Lye Products of Manufacture of Benzole	2d.
4455	J. W. Swan	Secondary Batteries for Effecting Electrical Storage	4d.
4456	W. Black and T. Larkin	Furnaces for Extraction of Sulphur from its Ores	4d.
4478	R. Harrison	Electric Lamps	6d.
4486	J. B. Readman	Obtaining Oxides and Salts of Certain Metals	4d.
4490	D. Rae	Artificially Producing Snow	2d.
4491	J. Imray	Manufacturing Soda by the Ammonia Method	6d.
4504	J. Brockie	Electric Arc Lamps	6d.
4508	J. H. Johnson	Production, Collection, and Storage of Electricity	4d.
4553	P. Jensen	Charging and Using Secondary Batteries	6d.
4555	E. Hagen	Apparatus for Production and Application of Ozonized Oxygen	2d.
4561	J. B. Kinnear	Destroying Putrescible Matter of Sewage, Separating the Solid Matter, and Obtaining Ammonia	4d.
4632	J. S. Sellon	Secondary Batteries	2d.
4635	F. M. Lyte	Treating Ores and Metallic Compounds, or Residual Products Containing Silver, Lead, or Copper	4d.
1882.			
384	W. R. Lake	Production of Aniline and Toluidine	6d.
634	W. R. Lake	Electric Lamps	6d.

THE ANALYST.

JULY, 1882.

SOCIETY OF PUBLIC ANALYSTS.

A General Meeting of this Society was held on the 28th June at Burlington House, Piccadilly; in the absence of the President through illness, the chair was taken by Dr. Muter, Vice-President.

The following papers were read and discussed :—

"On Samples of Milk which have fallen below the Society's limit," by W. Johnstone, F.I.C., F.C.S.

"On the Relation between the Specific Gravity, the Fat, and the Solids not Fat in Milk;" and

"A New Analysis of the Sandrock Mineral Water," by O. Hehner, F.I.C., F.C.S.

"On the Work done by Public Analysts during 1881, under the Sale of Food Act," by G. W. Wigner, F.I.C., F.C.S.

"On the use of Platinic Chloride as an Indicator in the Determination of Free Iodine," by T. P. Blunt, M.A., F.C.S.

[We are compelled to hold some of these Papers over until our next number. Ed. Analyst.]

NEW ANALYSIS OF THE SANDROCK (I.W.) MINERAL WATER.

By O. Hehner, F.I.C., F.C.S.

Read before the Society of Public Analysts, on 28th June, 1882.

Not far from the southern point of the Isle of Wight, about 150 yards distant from the shore, issues the Sandrock Spring, which yields the water of which the analysis is given below.

It was analysed in or a little before 1811, by Dr. Marcet, who reported that "every pint or sixteen-ounce measure of the water contained the following ingredients, viz.:—

"Of carbonic acid gas, three-tenths of a cubic inch.

"Sulphate of iron, in the state of crystallised green sulphate	41·4	grains.
"Sulphate of alumina, a quantity of which if brought to the state of "crystallised alum would amount to	31·6	"
"Sulphate of lime, dried at 160°	10·1	"
"Sulphate of magnesia, or Epsom salts, crystallised	3·6	"
"Sulphate of soda, or Glauber's salt, crystallised	16·0	"
"Muriate of soda, or common salt, crystallised	4·0	"
"Silica	0·7	"
	107·4	"

For purposes of comparison I have recalculated these figures, and the results will b[e] found below.

It is stated that the water has also been analysed by Berzelius, but I have not bee[n] able to find any record of his results. Possibly no independent analysis by Berzeliu[s] exists, as Berzelius and Marcet must have been at some time or other working together their joint names heading a paper on a different subject.

My own results are as follows :—

Specific gravity of the water at 60° F, 1008·9. 100,000 parts contain :—

		MARCET.
Cl ..	19·99	34·6
HCl ..	2·10	—
SO_3 ..	530·82	424·4
SiO_2	9·18	10·0
P_2O_5	0·38	—
FeO	146·34	153·0
Fe_2O_3	4·13	—
Al_2O_3	115·87	48·9
MnO	0·05	—
NiO	0·97	—
CaO	40·98	46·9
MgO	14·70	8·3
Na_2O	1·20	44·1
Na ..	12·95	22·4
K_2O	2·33	—
$(NH_4)_2O$	0·08	—
	902·07	792·6
Co ..	strong trace.	
I, Br & CO_2	absent.	
Free NH_3	0·0554	
Albuminoid NH_3	0·0132	

Combining the above substances to the salts most probably present, the results stand thus :—

NaCl	32·94	57·0
Na_2SO_4	2·75	101·0
K_2SO_4	4·30	—
$(NH_4)_2SO_4$	0·20	—
$FeSO_4$	308·94	323·0
Fe_23SO_4	9·25	—
Al_23SO_4	385·86	162·9
$Fe_2P_2O_8$	0·81	—
$CaSO_4$	99·52	113·8
$MgSO_4$	44·10	24·9
$MnSO_4$	0·11	—
$NiSO_4$	2·01	—
SiO_2	9·18	10·0
HCl (free) ..	2·10	—
	902·07	792·6
CO_2 (free) ..	—	10·8 c.c. per litre.

The water is, therefore, a remarkable one, not only for the extremely large amounts of ferrous and aluminic sulphates which it contains, but more so on account of the presence in it of a relatively very considerable quantity of nickel sulphate. I know of no water in which anything like the proportion of nickel stated above has been discovered. Nickel and

cobalt are not of unfrequent occurrence in the muds deposited by mineral springs, but in the water itself these metals are very rarely traceable.

Marcet's results are, on the whole, and considering the state of analytical chemistry in 1811, very creditable to that chemist. The main constituent, ferrous sulphate, found by him accords wonderfully near with my own figure. Probably he separated the various salts mainly by crystallization, as the terms employed in his report would indicate. I am inclined to attribute the differences in the two analyses rather to the methods of analysis than to any change in the composition of the water itself.

ON THE WORK DONE BY PUBLIC ANALYSTS DURING 1881 UNDER THE SALE OF FOOD AND DRUGS ACT.

By G. W. Wigner, F.I.C., F.C.S.

Read before the Society of Public Analysts, on 28th June, 1882.

A year ago I had the pleasure of summarising the returns made by Public Analysts as to the work done by them under the Sale of Food and Drugs Act during 1880, and of making some remarks on them; and I have now to bring before your notice another series of returns for 1881. These returns include the work of 78 Public Analysts, nearly all of whom are members of our Society; but a few who have not yet seen their way to join us, have been kind enough to favour us with the details of their work, so that the table might be made as complete as possible.

The object of this yearly summary is to point out the extent to which adulteration prevails year by year, earlier, and in a somewhat different way than it is reported in the blue books. These latter are, of course, issued at a later period of the year, and are arranged in a manner which does not enable us, as Public Analysts, to examine the facts contained in the various returns in the same way as we can in those we ourselves prepare.

Since the last paper on this subject appeared, very great steps have been taken, especially in the United States, towards the suppression of adulteration, and a number of different bills have been proposed in the various States, and most of them have been passed. The most satisfactory point in connection with them is, that nearly all contain what was originally proposed by this Society and pressed very strongly upon our own Government, viz., a distinct definition of adulteration, with limits or standards, showing what the constituents of any particular article are (according to the Act) expected to be. Had this course been followed in England, we should have been saved the annoyance which has been caused by the occasional contradiction of opinion between the Inland Revenue Chemists and the Public Analysts.

One very important publication in reference to adulteration has taken place during the past year, viz., the reports of the United States analysts who have, by the directions of the Government, examined the question of adulteration and its prevalence in almost all articles over the whole of the States. It is unnecessary to refer to that more fully, since the abstracts of the reports from the *Sanitary Engineer* (which is the official organ of the State Board of Health of New York) are being reprinted in The Analyst as rapidly as space will permit.

Several things have occurred lately to prove that the Sale of Food and Drugs Act needs further amendment; but in the present state of legislation it is, of course, quite impossible to hope for such a step this session, or even next.

Among the amendments which are essentially required, are the compulsory attendance of the referee chemists, whoever they may be, to verify their analysis on oath. It cannot be too well understood that their certificates at present *are not legal evidence.* Provision is also required for the compulsory collection of samples in larger numbers *pro rata* to the number of inhabitants.

Last year I mentioned that the probable number of samples examined was one out of every million samples purchased, and this year the number has fallen by a small fraction lower still. Taking only one illustration of the results of this imperfect examination of food supply, I may note that several of the larger dairymen supplying London absolutely reject milk, and fine the farmers who send it to them, when the standard falls down within 5 per cent. of as low as the Somerset House chemists are now passing, and if it falls within 8 per cent. of as low, the farmer receives a notice couched in somewhat unpleasant terms. It is little wonder then that they, as well as we, should look upon such a "standard," if so it can be called, as a premium upon adulteration.

Passing now from a general view of the subject to the details, we have the following results. The number of returns received of samples analysed and reported upon during the last seven years have been as follows:—

Year.	Districts.	Samples Examined.	Samples Adulterated.	Percentage Adulterated.
1875-6	109	15989	2895	18·10
1877	127	11943	2371	17·70
1878	168	15107	2505	16·58
1879	212	17574	3032	17·25
1880	237	17919	3132	17·47
1881	249	17868*	2960	16·56

It will be noted that the returns this year are from 12 more districts than we had last year, and that the number of samples has been somewhat less. 1881 shows a slight diminution in the percentage of adulteration, as compared with 1880, from 17·47 to 16·56—that is, after two years increase in percentage there is now a decrease—and the percentage is almost the same as it was in 1878. So far as appears from this, the good effect which the Act should have had has been, to a great extent, neutralized by its imperfect administration.

The following table shows the classification of the samples submitted to public analysts, including some few waters which, under arrangements which certain analysts have made, are included in the work they have to do under the Sale of Food Act. Dividing these articles into classes we have as follows:—

SAMPLES PURCHASED, 1879, 1880 AND 1881.

	Numbers.			Percentages.		
	1879.	1880.	1881.	1879.	1880.	1881.
Milk	6036	7251	6828	36·1	40·40	38·67
Butter	969	892	1081	5·7	4·97	5·86
Groceries	4197	3845	4328	25·0	21·48	24·17
Drugs	615	390	487	3·6	2·17	2·67
Wines, Spirits, and Beer	1615	2220	1967	9·7	12·36	10·86
Bread and Flour	1471	1326	1134	8·7	7·40	6·35
Water	1240	1604	1463	7·5	9·04	8·18
Sundries	629	391	580	3·7	2·18	3·24
	16,772	17,919	17,868	100·0	100·00	100·00

* The total in the tabulated statement is incorrectly put at 17808.

The figures in the last three columns show the percentage of samples purchased calculated upon the total.

In the following table the adulterated samples, which number 2,960 as against 3,132 last year, are classified with the corresponding figures for 1879 and 1880, the percentages being calculated upon the total number of samples found to be adulterated in each year.

SAMPLES FOUND ADULTERATED, OR IN THE CASE OF WATERS, UNFIT TO DRINK, 1879, 1880, AND 1881.

	Numbers. 1879.	1880.	1881.	Percentage. 1879.	1880.	1881.
Milk	1332	1595	1379	44·72	50·98	45·30
Butter	135	179	137	4·53	5·73	4·65
Groceries	492	402	420	16·52	12·90	15·27
Drugs	164	79	93	5·52	2·52	3·16
Wines, Spirits, and Beer	457	480	471	15·36	15·18	16·00
Bread and Flour	68	84	48	2·28	2·68	1·63
Waters	266	287	383	8·93	9·18	13·01
Sundries	64	26	29	2·14	·83	·98
	2978	3132	2960	100·00	100·00	100·00

In this case it appears that the percentage of milk adulteration has fallen very slightly. Groceries show an increase as against the decrease of the previous year; bread and flour a decrease. In the case of water there is a large increase in the amount of impurity found.

It is more important to examine the percentage of adulteration as compared with the number of samples of each article purchased, and for this reason I have taken five consecutive years—viz.: 1877 to 1881—and calculated the percentage of adulteration as found in each year on each class of goods.

PERCENTAGES OF ADULTERATION FOUND FROM 1877 TO 1881, CALCULATED ON THE NUMBER OF SAMPLES OF EACH CLASS ANALYSED.

	1877.	1878.	1879.	1880.	1881.
Milk	26·07	18·38	22·06	22·00	19·95
Butter	12·48	13·23	13·93	20·08	12·67
Groceries	13·03	12·89	11·73	10·43	9·70
Drugs	23·82	35·77	26·66	20·26	19·09
Wine, Spirits, and Beer	47·00	29·31	28·30	21·31	23·94
Bread and Flour	6·84	2·97	4·62	6·33	4·23
Water, Sundries	21·63	14·98			
Water			21·45	17·73	26·17
Sundries			10·17	6·66	5·00

This table is really the most important in the whole series, for it shows in what way the Act is working upon the vendors of different classes of goods. We find that milk still shows a fractional decrease in adulteration: it has not fallen down to the point reached in 1878, when the Act, if not worked more energetically than now, was certainly more of a terror to dairymen than at present, but 1879, 1880, and 1881, each show a small fractional decrease.

Butter has again fallen below the high figure which was reached last year and the comparatively high figures of the two previous years, and is down again almost to the point which it reached in 1877.

Groceries show a decided improvement.

Drugs show an improvement of more than 1 per cent. to be added to the 6 per cent. gain of the previous year.

Wines, spirits, and beer show a fractional improvement, which brings them almost to the average of 1879.

Now taking the samples examined in the Metropolitan district alone we get the following results :—The total number purchased was 2806, of which 398, or 14·21 per cent., were adulterated, this being as nearly as possible 1 per cent. less than last year. These samples are divided thus :—

METROPOLITAN DISTRICTS—PERCENTAGE OF ADULTERATION, 1881.

	Examined.	Adulterated.	Percentage.
Milk	935	247	26·31
Butter	238	34	14·28
Groceries	856	68	7·94
Drugs	51	4	7·84
Wines, Spirits, and Beer	188	24	12·76
Bread and Flour	238	3	1·30
Waters	96	15	15·62
Sundries	204	3	1·47
	2,806	398	14·21

The only noticeable changes in this table from that which I gave last year are that the samples of butter show about 7 per cent. less adulteration, and those of wines, spirits, and beer about 6 per cent. more.

Next we have 153 Towns where 6,439 samples have been examined. This is about 700 less than was examined in almost the same number of towns during the previous year. The percentage of adulteration is 19·56 as against 17·87 last year.

TOWNS IN THE UNITED KINGDOM—PERCENTAGE OF ADULTERATION, 1881.

	Examined.	Adulterated.	Percentage.
Milk	3721	742	19·94
Butter	298	64	21·47
Groceries	993	165	16·61
Drugs	78	11	14·10
Wines, Spirits, and Beer	361	89	24·65
Bread and Flour	325	12	3·69
Waters	513	166	32·35
Sundries	150	11	7·33
	6,439	1,260	19·56

In this case the notable changes are a fractional improvement of nearly 2 per cent. in the case of milk, about 4½ per cent. improvement in butter, 10 per cent. in groceries, 6 per cent. in drugs, a deterioration in bread and flour, and a marked deterioration in the purity of water supplied for domestic use.

Passing from the towns to the counties we have reports from 74 counties and divisions of counties, as against 65 last year, with a total of about 500 more samples examined. The percentage of adulteration in these counties appears to have decreased from 17·84 to 15·09.

COUNTIES IN THE UNITED KINGDOM. PERCENTAGE OF ADULTERATION, 1881.

	Examined.	Adulterated.	Percentage.
Milk	2130	392	18·40
Butter	550	41	7·45
Groceries	2490	195	7·83
Drugs	364	79	28·34
Wines, Spirits and Beer	1427	355	24·87
Bread and Flour	552	29	5·24
Waters	880	208	23·63
Sundries	230	3	1·30
	8623	1302	15·09

Butter and groceries appear to be the articles to which the decrease is most due; the adulteration of the former having decreased from 15·69 to 7·45, and the latter in almost equal proportion. "Sundries" show a marked decrease, but the number analysed is so small that it scarcely tells on the total.

The relative proportion of samples purchased in London, the large towns, and counties, show as follows:—London, 15·70 per cent.; large towns, 36·04 per cent.; counties, 48·26 per cent.; and I now place before you a table which shows side by side the relative percentage of adulteration found in them.

METROPOLIS, TOWNS, AND COUNTIES. PERCENTAGE OF ADULTERATION, 1881.

	London.	Large Towns.	Counties.	Whole Country.
Milk	26·31	19·94	18·40	19·95
Butter	14·28	21·47	7·45	12·67
Groceries	7·94	16·61	7·83	9·70
Drugs	7·84	14·10	28·34	19·09
Wines, Spirits, and Beer	12·76	24·65	24·87	23·94
Bread and Flour	1·30	3·69	5·24	4·23
Waters	15·62	32·35	23·63	26·17
Sundries	1·47	7·33	1·30	5·00

I must leave these statistics to be examined, and the deductions to be drawn from them by others, except as regards one or two points. Milk adulteration remains as it always has done, one of the crying shames of the country. Probably it does not exceed the mark when I say that £100,000 a year is paid in the Metropolitan District alone for water which is sold at the price of milk. In this case the public are simply robbed, and the profit does not go to the Water Companies, but to the milkmen.

In the case of butter, which ranks almost next worse among the list of adulterations, it is, perhaps, more strictly correct to say that the public are cheated rather than robbed, because they get a "fat" of an inferior quality and slightly less palatable, but which is is still "fat" in substitution for the butter which they intended to buy.

The low figure of the alcoholic strength of the wines, spirits, and beer may be passed over as before, on the ground that the public ought to be able to take care of themselves in *this* respect, and that probably it is quite as well that they can buy spirits of low alcoholic strength at a low price as strong spirits at an increased price.

As to drugs I can say nothing. It is true that the number of samples analysed is small, as it always has been since these returns have been made—487 only were examined last year—but certainly "druggists" should be above suspicion, and it is a sad thing to see the percentage of adulteration rise as high as 19·09 per cent. In my opinion it would have been far better had I been able to say that every one of these cases had been taken into court, so that, to put it in the mildest way, errors made by trained men might have been exposed.

The usual although very unpleasant sequence to my annual report is to point out that there are seven counties and 43 towns, besides one Metropolitan District—St. Martin's —in which the Act has been absolutely ignored, and nothing whatever was examined during the year. And in addition there are four counties and 26 towns where the amount of work performed has been utterly inadequate to the number of inhabitants, so that there are 80 counties, cities, and towns in the United Kingdom, and one important Metropolitan District, where the authorities have very successfully shown how "not to do it" in the way of complying with one of the most salutary Acts that has been passed during this generation.

As illustrations of the curiosities of adulteration I may add that Mr. Gatehouse reports marmalade and jam as containing saltpetre; Mr. Stock, whisky containing capsicum; Mr. Tatlock, skim milk containing chalk: and Mr. Allen, muffins containing plaster of Paris, and oatmeal containing chalk.

SOCIETY OF PUBLIC ANALYSTS.

Analyses of English Public Water Supplies in June, 1882. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Date when drawn.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine in Chlorides.	Phosphoric Acid in Phosphates.	Nitrogen in Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in 15 mins. at 80° Fahr.	Oxygen, Absorbed in 4 hours at 80° Fahr.	Hardness, Clark's Scale, in degrees. Before Boiling.	Hardness, Clark's Scale, in degrees. After Boiling.	Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
Kent Co.	May 30	c. p. blue	none	1·91	none	·16	trace	·0037	none	·006	21 2°	5·6°	33·4	vegetable debris	Wigner & Harland.
New River	June 14	clear	none	1·20	trace	·15	·0028	·0018	·017	·041	14·0°	3·5°	19·6	satisfactory	B. Dyer.
East London ..	,, 9	c. yell. green	none	1·27	slight	·11	·0016	·0023	·014	·032	14·8°	3·0°	18·0	veg. deb., fibres, anml.	Wigner & Harland.
Southwark & Vauxhall ..	,, 5	p. y. & clear	none	1·24	trace	·12	·0014	·0070	·023	·057	15·0°	4·0°	18·9	none	John Muter.
West Middlesex	,, 21	f. yellow	none	1·08	trace	·11	·0015	·0062	·023	·042	12·5°	3·0°	18 0		O. Hehner.
Grand Junction	,,	p. yellow	none	1·02	trace	·28	·0011	·0045	·010	·081	14·4°	3·3°	21·0		A. Wynter-Blyth.
Lambeth	,, 5	p. y. & clear	none	1·24	trace	·12	·0014	·0070	·024	·062	16·0°	3·5°	18·9	none	John Muter.
Chelsea	,, 19	c. p. brn. green	none	1·22	trace	·05	none	·0048	·022	·050	16·5°	4·5°	13·4		A. Dupré.
Birmingham ..	June 2	turb. grnsh.	none	1·33	trace	·13	·0014		·022	·078	9·8°	7·9°	20·7	veg. debris and forms	A. Hill.
Bolton........	,, 16	v. s. turb.	none	·40	none	·03	·0011	·0022	·010	·020	3·5°	3·5°	7·1	satisfactory	W. H. Watson.
Brighton......	,, 8	c. p. blue	none	1·97	none	·19	·0021	·0017	none	·008	13·6°	3·1°	20·4	veg. deb., fibres, anml.	Wigner & Harland.
Bristol........	,, 12	grnsh. brown	none	1·20	none	·06	·0005	·0025	·016	·025	17·5°	2·8°	22·0	sand, algæ	F. W. Stoddart.
Cambridge	,, 19	c. p. blue	none	1·40	trace	·42	none	·0020	none	·016	18·0°	5·0°	24·8	satisfactory	J. West Knights.
Croydon	,, 20	c. colourless	none	1·19	trace	·27	none	none	none	·007	15·0°	6·0°	22·4	none	C. Heisch.
Dublin........	May 31	light yellow	none	·86	trace	trace	·0020	·0055	·063	·215	1·3°	·6°	4·4	satisfactory	C. A. Cameron.
Edinburgh	June 15	v. s. brown	none	·80	none	trace	·0008	·0056	·012	·038	4·2°	3·9°	4·8	none	J. Falconer King.
Exeter........	,, 12	f. b. yellow		·84	trace	·13	·0018	·0059	·038	·086	2·4°	2·4°	5·6		F. P. Perkins.
Grantham	,, 21	c. p. blue	none	·81	trace	·34	·0006	·0006	none	·004	15·3°	3·3°	21·9	satisfactory	A. Ashby.
Hastings......	, 15	p. grnsh. blue	none	4·50	trace	·12	·0014	·0035	·002	·008	7·5°	4·0°	22·7	v. slight	H. F. Cheshire.
King's Lynn ..	,, 15	dirty yell.	weedy	1·28	trace	·32	none	·0112	·093	·305	14·5°	4·5°	23·8		W. Johnstone.
Liverpool	,, 26	light green	none	1·02	trace	·03	·0014	·0049	·018	·066	3·5°	3·3°	7·2		A. Smetham.

SOCIETY OF PUBLIC ANALYSTS.

Analyses of English Public Water Supplies in June, 1882. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Date when drawn.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine in Chlorides.	Phosphoric Acid in Phosphates.	Nitrogen in Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in		Hardness, Clark's Scale, in degrees.		Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
									15 mins. at 80° Fahr.	4 hours at 80° Fahr.	Before Boiling.	After Boiling.			
Maidstone—															
Wtr. Company	June 14	p. green	none	2·50	trace	·71		·0042	·012	·030	18·0°	7·0°	33·7		M. A. Adams.
Public Conduit	,, 14	p. blue	none	2·30	trace	·68		·0014	·016	·031	18·5°	7·0°	32·8		M. A. Adams.
Newark	,, 19	c. p. blue	none	1·26	trace	·04	·0008	·0043	·013	·031	17·2°	13·4°	36·0	satisfactory	A. Ashby.
Newcastle-on-Tyne......	,, 8	f. yell. s. turb	none	·94	trace	·03	·0010	·0080	·061	·100	13·4°	4·0°	16·5	satisfactory	J. Pattinson.
Nottingham ..	,, 12	c. grnsh. blue	none	1·49	trace	·65	·0034	·0022	none	·028	11·2°	6·7°	22·6	vegetable debris	Wigner & Harland.
Norwich	,, 20	p. grnsh. yell.	none	1·80	trace	·08	trace	·0070	·032	·052	11·0°	3·7°	13·2	satisfactory	W. G. Crook.
Portsmouth ..	,, 13	clear	none	1·15	trace	·18	none	·0063			12·2°	2·3°	18·5	veg. deb., diatoms	W. J. Sykes.
Rugby	,, 2	c. p. yellow	none	1·68	trace	·02	·0110	·0142	·0595	·101	18·0°	8·5°	29·1	veg. deb., diatoms	A. P. Smith.
Salford	,, 2	c. s. yellow	none	·70	none	none	·0007	·0017	·003	·027	3·0°	2·5°	4·0	none	J. Carter Bell.
Southampton ..	,, 24	c. p. yellow	none	·91	trace	·27	trace	·0110	·036		12·2°	4·4°	20·6	veg. deb., diatoms	A. Angell.
Swansea	,, 26	clear	none	1·00	trace	none	·0007	·0042	·003	·004	1·4°	1·4°	3·5	none	W. Morgan.
Whitehaven ..	,, 13	c. f. green	none	·43	trace	·007	none	·0011	·007	·015	·4°	·4°	2·2	veg. deb., diatoms	A. Kitchin.

Abbreviations:—c., clear; f., faint; h., heavy; p., pale; v. h., very heavy; v. s., very slight.

SOCIETY OF PUBLIC ANALYSTS.

Analyses of English Public Water Supplies in June, 1882. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Date when drawn.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine in Chlorides.	Phosphoric Acid in Phosphates.	Nitrogen in Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in 15 mins. at 80° Fahr.	Oxygen, Absorbed in 4 hours at 80° Fahr.	Hardness, Clark's Scale, in degrees. Before Boiling.	Hardness, Clark's Scale, in degrees. After Boiling.	Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
Kent Co.	May 30	c. p. blue	none	1·91	none	·16	trace	·0037	none	·006	21 2°	5·6°	33·4	vegetable debris	Wigner & Harland.
New River	June 14	clear	none	1·20	trace	·15	·0028	·0018	·017	·041	14·0°	3·5°	19·6	satisfactory	B. Dyer.
East London	,, 9	c. yell. green	none	1·27	slight	·11	·0016	·0023	·014	·032	14·8°	3·0°	18·0	veg. deb., fibres, anml.	Wigner & Harland.
Southwark & Vauxhall	,, 5	p. y. & clear	none	1·24	trace	·12	·0014	·0070	·023	·057	15·0°	4·0°	18·9	none	John Muter.
West Middlesex	,, 21	f. yellow	none	1·08	trace	·11	·0015	·0062	·023	·042	12·5°	3·0°	18 0		O. Hehner.
Grand Junction	,,	p. yellow	none	1·02	trace	·28	·0011	·0045	·010	·081	14·4°	3·3°	21·0		A. Wynter-Blyth.
Lambeth	,, 5	p. y. & clear	none	1·24	trace	·12	·0014	·0070	·024	·062	16·0°	3·5°	18·9	none	John Muter.
Chelsea	,, 19	c. p. brn. green	none	1·22	trace	·05	none	·0048	·022	·050	16·5°	4·5°	13·4		A. Dupré.
Birmingham	June 2	turb. grnsh.	none	1·33	trace	·13	·0014		·022	·078	9·8°	7·9°	20·7	veg. debris and forms	A. Hill.
Bolton	,, 16	v. s. turb.	none	·40	none	·03	·0011	·0022	·010	·020	3·5°	3·5°	7·1	satisfactory	W. H. Watson.
Brighton	,, 8	c. p. blue	none	1·97	none	·19	·0021	·0017	none	·008	13·6°	3·1°	20·4	veg. deb., fibres, anml.	Wigner & Harland.
Bristol	,, 12	grnsh. brown	none	1·20	none	·06	·0005	·0025	·016	·025	17·5°	2·8°	22·0	sand, algæ	F. W. Stoddart.
Cambridge	,, 19	c. p. blue	none	1·40	trace	·42	none	·0020	none	·016	18·0°	5·0°	24·8	satisfactory	J. West Knights.
Croydon	,, 20	c. colourless	none	1·19	trace	·27	none	none	none	·007	15·0°	6·0°	22·4	none	C. Heisch.
Dublin	May 31	light yellow	none	·86	trace	trace	·0020	·0055	·063	·215	1·3°	·6°	4·4	satisfactory	C. A. Cameron.
Edinburgh	June 15	v. s. brown	none	·80	none	trace	·0008	·0056	·012	·038	4·2°	3·9°	4·8	none	J. Falconer King.
Exeter	,, 12	f. b. yellow		·84	trace	·13	·0018	·0059	·038	·086	2·4°	2·4°	5·6		F. P. Perkins.
Grantham	,, 21	c. p. blue	none	·81	trace	·34	·0006	·0006	none	·004	15·3°	3·3°	21·9	satisfactory	A. Ashby.
Hastings	,, 15	p. grnsh. blue	none	4·50	trace	·12	·0014	·0035	·002	·008	7·5°	4·0°	22·7	v. slight	H. F. Cheshire.
King's Lynn	,, 15	dirty yell.	weedy	1·28	trace	·32	none	·0112	·093	·305	14·5°	4·5°	23·8		W. Johnstone.
Liverpool	,, 26	light green	none	1·02	trace	·03	·0014	·0049	·018	·066	3·5°	3·3°	7·2		A. Smetham.

SOCIETY OF PUBLIC ANALYSTS.

Analyses of English Public Water Supplies in June, 1882. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Date when drawn.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine in Chlorides.	Phosphoric Acid in Phosphates.	Nitrogen in Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in 15 mins. at 80° Fahr.	Oxygen, Absorbed in 4 hours at 80° Fahr.	Hardness, Clark's Scale, in degrees. Before Boiling.	Hardness, Clark's Scale, in degrees. After Boiling.	Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
Maidstone—															
Wtr. Company	June 14	p. green	none	2·50	trace	·71		·0042	·012	·030	18·0°	7·0°	33·7		M. A. Adams.
Public Conduit	„ 14	p. blue	none	2·30	trace	·68		·0014	·016	·031	18·5°	7·0°	32·8		M. A. Adams.
Newark	„ 19	c. p. blue	none	1·26	trace	·04	·0008	·0043	·013	·031	17·2°	13·4°	36·0	satisfactory	A. Ashby.
Newcastle-on-Tyne......	„ 8	f. yell. s. turb	none	·94	trace	·03	·0010	·0080	·061	·100	13·4°	4·0°	16·5	satisfactory	J. Pattinson.
Nottingham ..	„ 12	c. grnsh. blue	none	1·49	trace	·65	·0034	·0022	none	·028	11·2°	6·7°	22·6	vegetable debris	Wigner & Harland.
Norwich	„ 20	p. grnsh. yell.	none	1·80	trace	·08	trace	·0070	·032	·052	11·0°	3·7°	13·2	satisfactory	W. G. Crook.
Portsmouth ..	„ 13	clear	none	1·15	trace	·18	none	·0063			12·2°	2·3°	18·5	veg. deb., diatoms	W. J. Sykes.
Rugby	„ 2	c. p. yellow	none	1·68	trace	·02	·0110	·0142	·0595	·101	18·0°	8·5°	29·1	veg. deb., diatoms	A. P. Smith.
Salford	„ 2	c. s. yellow	none	·70	none	none	·0007	·0017	·003	·027	3·0°	2·5°	4·0	none	J. Carter Bell.
Southampton ..	„ 24	c. p. yellow	none	·91	trace	·27	trace	·0110	·036		12·2°	4·4°	20·6	veg. deb., diatoms	A. Angell.
Swansea	„ 26	clear	none	1·00	trace	none	·0007	·0042	·003	·004	1·4°	1·4°	3·5	none	W. Morgan.
Whitehaven ..	„ 13	c. f. green	none	·43	trace	·007	none	·0011	·007	·015	·4°	·4°	2·2	veg. deb., diatoms	A. Kitchin.

Abbreviations:—c., clear; f., faint; h., heavy; p., pale; v. h., very heavy; v. s., very slight.

PRELIMINARY NOTICE ON THE COMPOSITION OF THE BLACK DEPOSIT WHICH ATTACHES ITSELF TO THE POSITIVE ELECTRODE OF THE BATTERY ON ELECTROLYSING SOLUTIONS OF ARGENTIC NITRATE.

By J. W. Gatehouse.

Read before the Society of Public Analysts on 31st May, 1882.

The composition of this substance is generally stated in our text books to be such that its formula is Ag_2O_2. The few experiments, however, which I have been able to perform indicate that its composition varies both with the battery power used and with the strength of the solution. In all cases it appears to contain a very large amount of absorbed gas, consisting principally of oxygen, but in no case free from nitrogen.

With a saturated solution of silver nitrate, or so nearly saturated as not to deposit crystals during the process of electrolysis, and a current proceeding from two pint Grove cells, the deposit at the positive pole is almost black, highly crystalline, and fairly coherent, so that, although much may have fallen to the bottom of the cell, the remainder can be withdrawn attached to the platinum electrode.

During the process a purple tint first pervades the solution, gradually turning to a deep brown; this, first appearing at the positive pole, gradually stretches through the solution till it reaches the negative electrode, which also consists of platinum.

The silver deposited on this electrode gradually stretches through the solution in a fine arborescent form till it meets the deposit on the opposite side. Although some of the black deposit adheres to the electrode, much drops to the bottom of the cell, and this, in addition to the oxygen gas given off from the positive electrode itself, yields a constant stream of gas, whether in solid connection with the electrode or not. This evolution of gas proceeds at ordinary temperature, even after all silver nitrate has been removed by washing, and the finer the state of division in which the deposit is formed the greater appears to be the amount of gas absorbed by it. After being heated to 212° F. its composition is constant. The deposit evolves oxygen freely when treated with concentrated sulphuric acid, and chlorine when treated with hydrochloric acid.

2·42 grains of the crystalline deposit obtained by using two Bunsen cells was heated for an hour to 120° F., the gas evolved was not measured with great accuracy, but consisted of about 2 c.c., of which approximately nine-tenths were oxygen and the remainder nitrogen.

These 2·42 grains raised to a white heat were reduced to pure silver, the weight of which was 1·985 grains; loss of gas, ·435 grains. On the supposition that the whole of the gas thus lost was oxygen, this gives the composition of the substance at 120° F., as silver, 82·02 per cent.; oxygen, 18·00 per cent.; and leads to the formula Ag_2O_3 being the correct one at this temperature.

With a power of four Bunsen cells, and a slightly acid solution, a fine black powder was obtained, from which volumes of gas continuously ascended as it lay at the bottom of the decomposing cell. There was no trace of adherent crystals, the platinum electrode being merely covered with a fine black powder, and the solution itself took a magnificent violet tint, soon passing to a deep brown, from all parts of which the brown deposit seemed to form; but it was difficult to distinguish whether this was actually the case or not, as the evolution of gas from the deposited powder was so rapid as to produce currents which carried particles around from bottom to the top, exactly as we see in the case of convection currents.

A portion of this brown powder was washed as rapidly as possible, transferred to a graduated tube fitted with a cork, and small tube at the bottom, but with the small tube reaching some two inches into the larger graduated one. We thus have a species of Ure's eudiometer, with the open limb small, and entering the large one.

The deposit lies at the bottom of the large tube, between it and the small one, and can be thus conveniently heated in a water-bath.

Three c.c. of gas were thus collected; of this 2·75 c.c. were absorbed by pyrogallic acid and soda, leaving ·25 c.c. of nitrogen. The total amount of solid matter remaining after expulsion of the gas was only ·23 grains, of which only ·06 grains remained as silver after being heated to redness. The amount here being very small, and the chances of error great, I do not place much reliance on the composition of the substance, as deduced from this experiment, but merely give it as showing the enormous comparative quantity of gas which may, under certain circumstances, be occluded by a small amount of this solid.

In a third experiment, where the deposit was crystalline, and the total solid weighed 6·73 grains, 4 c.c. of gas were collected, of which 3·7 were absorbed by soda and pyrogallic acid, and ·3 c.c. of nitrogen remained unabsorbed.

These experiments (which are, indeed, only preliminary work on the subject, and as such I take the liberty of placing them before the Society) do not, indeed, settle the composition of this interesting deposit, nor throw any light on that still more unknown subject of the formation of the purple colour in the solution of the nitrate during the electrolysis; yet I hope they indicate a field of interesting study which I trust may be entered into by men abler than myself, and with more time to devote to the subject.

COFFEE ADULTERATION.

WITH reference to the clause from the Customs and Inland Revenue Bill, which we printed in our last number, our contemporary, *The Chemist and Druggist*, thought it rather hard that if any person should really desire to have a combination of coffee and dandelion he should be prevented by law from purchasing such, and accordingly wrote to the Chancellor of the Exchequer to ask if such a mixture would be allowed to be sold provided the proportions of the ingredients were definitely stated. The following reply indicates that dandelion, or taraxacum, coffee will be allowed to be sold as heretofore:—

Inland Revenue, Somerset House, May 25th, 1882.

SIR,—The Chancellor of the Exchequer having forwarded to this department your letter of the 2nd instant, I am instructed by the Board to acquaint you, in reply, that

dandelion root will, it is understood, be considered as analogous to chicory; and, provided duty be paid accordingly as for chicory, no objection will be raised to the sale of a mixture of dandelion root and coffee. I am, &c.,

(Signed) CHARLES B. FORSEY,

The Editor of *The Chemist and Druggist.* Secretary.

Perhaps some other enterprising Trades' Journal will write asking a similar question as to turnips, figs, dates, &c., or our contemporaries in the milk line might endeavour to get equally favourable consideration for those persons who "really desire to have a combination of" milk and water sold to them by their milkmen.

PARLIAMENTARY INTELLIGENCE.

Lard Cheese.

In the House of Commons, on the 12th June, Mr. R. Paget asked the President of the Board of Trade whether his attention had been called to the manufacture, in the United States of America, of an article called cheese, compounded of a mixture of the bluest skim-milk and lard, and whether he would endeavour to ascertain if any of this spurious cheese was imported into this country; and, if so, whether he would take steps to insure that this compound, when exposed for sale, should be sold only as "lard chese," or be distinguished in such a manner as to prevent imposition on purchasers in this country.

Mr. W. Egerton also asked the President of the Board of Trade whether he had read the report of Dr. Voelcker to the Royal Agricultural Society, on the composition of lard and oleo-margarine cheese lately imported from America; and whether he would cause inquiries to be made at the ports of entry relative to the importation of such cheeses, so that they might be entered and sold under their proper designation, and not as "whole milk" cheeses.

Mr. Chamberlain: As the hon. member for Mid-Cheshire has also given notice of a question on this subject, I may, perhaps, be allowed to answer the two questions together. My attention has been directed to the manufacture of an article called "cheese," compounded of skim-milk and lard, and I am aware that this article is being imported into this country. I have made inquiries of the Custom House, but at present the import and export statistics do not make any distinction between this cheese and ordinary cheese, and I am consequently unable to give any information as to the extent of the importation; but the question of statistics is at the present time being considered by a small departmental committee, and I will refer the question of providing for a distinct classification in future to the committee. As regards the sale in this country, the Adulteration Acts impose a penalty of £20 on any person selling any article of food not of the nature, substance, or quality demanded by the purchaser, without disclosing the fact, and this enactment would, I presume, serve to prevent imposition. I have also read the report of Dr. Voelcker, alluded to by the hon. member for Mid-Cheshire, and find that he states that, as far as he can judge at present, "the lard and oleo-margarine cheeses are wholesome and nutritious articles of food, which cannot be distinguished by their appearance and general properties from ordinary cheese." I am, moreover, doubtful whether in any case it is desirable to interfere further with the production or sale of this article, even in the interests of agriculturists, as I find that Lord Vernon, who took the chair at a recent meeting of the Agricultural Society, expressed his opinion that the Society should be very careful before requesting the interference of the Board of Trade, as one of the great obstacles to butter-making was the difficulty of getting rid of the skim-milk, whereas by the introduction of lard or oleo-margarine the dairy companies would be able to work up their refuse-produce into a wholesome article of food. It appears, therefore, that the British farmer may possibly desire to enter into this manufacture.

Mr. W. Egerton, on Thursday, the 15th June, asked the President of the Board of Trade a question of which he had given him private notice—viz., whether in an answer given on Monday last he had not attributed to Lord Vernon language which had really been used by the President of the Royal Agricultural Society.

Mr. Chamberlain: I am much obliged to the hon. member for pointing out that in my answer on Monday last I attributed to Lord Vernon certain remarks that were really uttered by the President of

the Royal Agricultural Society. The report from which I derived my information put these remarks down to the President, having previously spoken of Lord Vernon as chairman, and hence my mistake. These remarks were to the effect that the introduction of lard or oleo-margarine would enable dairy companies to work up their skim-milk into a wholesome article of food; that the Council should be careful before writing to request the interference of the Board of Trade, as it was a question whether the public were not benefited by such forms of cheap and wholesome food. I am very glad to have the opinion of so eminent an authority as the President of the Royal Agricultural Society on this subject, and I may say that from all the information I have been able to get I am inclined to agree entirely with his view. These remarks were made by the President before Dr. Voelcker's report, but after a statement by Dr. Voelcker, which his subsequent report confirmed, that these cheeses were perfectly wholesome food. The letter from the Royal Agricultural Society was received on June 9.

Mr. Macfarlane, on the 22nd June, asked the President of the Board of Trade what steps he proposed to take to protect the public from imposition in the matter of the new "wholesome and cheap" Cheddar and other cheese, which was composed of skimmed milk and various fats, and if he would compel the vendors of such substances to affix notices in their shops and upon the articles, stating plainly that they were imitatlons, and, if possible, what they were made of, and where they were made.

Mr. Dodson: I have undertaken to answer this question, and I do not know that the Government can take any steps to protect the public from imposition in the matter of the "wholesome and nutritious" Cheddar and other cheese referred to, nor does it seem necessary that they should be empowered to do so, as proceedings are open to every purchaser in regard to the sale of adulterated articles. If a shopkeeper sells as cheese an article which contains foreign ingredients, and the purchaser is prejudiced thereby, the shopkeeper can be proceeded against—for penalties—under the Sale of Food and Drugs' Act, and the seller can only protect himself by delivering to the purchaser, at the time of sale, a notice to the effect that the article is mixed.

Mr. Macfarlane gave notice that he would take an early opportunity of calling attention to the inadequacy of the Sale of Food Act to protect the poor.

ALLEGED ADULTERATION OF LIQUORS IN NEW YORK.

An attempt will be made before the adjournment of the New York Legislature to supplement the new Excise bill with an act providing for the suppression of adulteration of liquors. The proposed bill is nearly completed, and, it is understood, will be forwarded to Assemblyman Alvord for introduction. To a reporter a retired wholesale liquor dealer said when questioned concerning the manner of adulterating liquors: "If I should give you the tricks of the trade, and with my name, this city would be a hot place for me. But few liquor drinkers have the faintest idea in regard to the extent of the evil of adulteration. For instance, more than two-thirds of the stuff sold for brandy in this country is the meanest kind of poison. It is manufactured from an oil of cognac. Dr. Cox, the celebrated inspector of liquors for Ohio, after examining some of these imported brandies, said that the chemical tests gave him fusil oil as a basis, with sulphuric acid, copper, chloroform, tannic acid, Guinea pepper, and a small percentage of good brandy. The same gentleman, after testing liquor from a half pipe of 'splendid Seigrette brandy,' found evidences of sulphuric acid, nitric acid, nitric ether, prussic acid, Guinea pepper, fusil oil, and common whiskey. Gin," continued the ex-liquor dealer, "is considered a safe drink by thousands, who believe it is the only liquor which escapes adulteration. They are mistaken. In most of the gin sold there will be found oil of vitroil, oil of turpentine, oil of almonds, sulphuric ether, and extract of grains of paradise. It is in the manufacture of whiskey, however, that the adulterators do their finest work. You can purchase oils and essences from which 'whiskey of any age' can be produced. This style of whiskey when tested will show sulphuric acid, caustic potassa, benzine, nux vomica, and other poisons. This is the sort of stuff that bores into the coatings of the stomach and creates ulcers. Pure whiskey, in my opinion, will hurt no one when taken in reasonable quantities, but this adulterated stuff is murderous. In porter you will find opium, henbane, capsicum, cocculus indicus, copperas, tobacco, and sulphuric acid. In beer, alum, opium, nux vomica, green copperas, vitriol, sub-carbonate of potash, and jalap are used. Of course ale of this character is dangerous to drink. If you don't believe me, drop in at any of the beer shops near the wharves of the East or North rivers and drink one of the 'schooners' that are sold for five cents. If it does not produce complete nausea it will surely cause intoxication. Cocculus indicus is used largely in this kind

of beer. It is used to give strength to the beer. It is a small berry, very bitter, and of an intoxicating character. Three grains will produce nausea and prostration; ten grains will throw a strong dog into convulsions. Now you can understand how strong men, after drinking beer dosed with this poison, lose for a time all power of locomotion. Fox-glove and henbane are used for about the same purposes as cocculus indicus. Jalap is used to offset the astringent qualities of acids. Oil of vitriol is used to increase the heating qualities of liquor. Wormwood is used for its bitter and stimulating qualities. Green copperas gives porter a frothy 'head,' and the drinker as well. Slaked lime is also to be found in adulterated porter."—*New York Times.*

THE ADULTERATION OF DRUGS.

Among manufactured pharmaceuticals there is, perhaps, no more frequent and difficultly detected method of imposing upon careless or ignorant buyers than by withholding or replacing some expensive ingredient. A case in point is the compound extract of colocynth of the Pharmacopœia, which is largely used as a cathartic in pill form. This should contain:—

Extract of colocynth	15·2 per cent.
Purified aloes	52·2 ,,
Resin of scammony	13·0 ,,
Powdered cardamoms	6·5 ,,
Powdered soap	13·0 ,,

Unfortunately, two ingredients are rather expensive, and there seems to be evidence that one (the resin of scammony) is sometimes left out entirely, while another (the purified aloes) is replaced by ordinary powdered aloes, which is much cheaper. Even this hypothesis, while it explains why some makers can furnish a so-called "compound extract of colocynth" at less than first cost for the proper ingredients, can hardly make it clear how some dealers can furnish true compound cathartic pills—in which the compound extract of colocynth should form 51·6 per cent. at the low prices which they quote. The goods furnished may be of first quality but short in weight, measure, or concentration. Instance short weight quinine pills. Among liquids, a certain specific gravity, weight per gallon, or degree according to some understood scale is accepted in the trade as evidence of proper strength. A writer has found that, as a rule, these standards are actually lived up to and not infrequently exceeded by manufacturers, while some particular brands are usually below the accepted standard; thus, some acids, otherwise good, fall short a few degrees, and the maker is paid for several per cent. of real acid which he does not furnish. In large transactions these shortages amount to a considerable sum. Among drugs, volatile oils are especially liable to be adulterated, usually with fixed oils, sometimes with other volatile oils, chloroform, alcohol, &c. Copaiba and various balsams and resins are not always as good as they look; in fact, adulterators seem sometimes to be too ingenious to be easily caught. There is great temptation to adulterate quinine and morphine, but these standard articles are tested daily and fraud is too quickly discovered to flourish. The statements here made are based on the personal knowledge and experience of the writer; they might be considerably extended should it seem necessary, but enough has been said to show the necessity for constant vigilance on the part of those to whom the State entrusts the responsibility of guarding the purity of food and drugs. It seems in this connection, that the State Board of Health is taking the safest course in first investigating thoroughly the question before proposing new legislation. It will doubtless appear that the ground that an article is prejudicial to the public health is often less secure than this—that the purchaser is not getting that for which he pays.—*Sanitary Engineer of New York.*

LAW REPORT.

Drug Adulteration.—Grocers Fined:—

Three grocers—Mr. Joseph Green, of Hyde; Mr. James Buckley, of Micklehurst; and Mr. Thomas Farrand, of Micklehurst—were summoned to the Hyde police court, on the 19th ult., the two first-named for selling sweet spirits of nitre which had been diluted to the extent of 25 per cent. with water, according to the certificate of Mr. Carter-Bell, the county analyst for Cheshire; and the latter for selling paregoric which, according to the same authority, did not contain opium. In each case the plea was that the article was sold as received, but, as the defendants had omitted to obtain a written warranty from the wholesale house, they were each ordered to pay 10s. and costs.

REPORTS ON ADULTERATION IN THE STATE OF NEW YORK.

From the *Sanitary Engineer*, New York.

(Continued from page 98.)

Group III.

Canned Meats and Animal Foods:—Meats—Fresh, Smoked, Salted, Canned; Extracts and Essences of Meat and Fish; Gelatin and Isinglass.

Report by Prof. A. H. Chester, Ph.D., of Hamilton College, Clinton, N. Y.

MEAT.

Dr. Chester commences by calling attention to the importance of meat as an article of diet. The superiority of the English over Continental nations is attributed, in a great part, to the beef and mutton which are so freely consumed in Great Britain. "It is found that, while milk, butter, and cheese will be great additions to an otherwise purely vegetable diet, meat is the great work-producing agent."

"Fresh meat is undoubtedly the most important and valuable kind of animal food, as either salting or smoking it makes it less easily digestible."

There are two contaminations to which fresh meat is subject, and with reference to which the health authorities are called upon to protect the public: the first is the putrefaction or decomposition of meat, and the second refers to the presence of parasites. So far as the putrefactive changes in meat are not checked by the presence of antiseptics, the public is able to protect itself; but where the meat becomes in any way impaired by causes the effects of which are not immediately discernible, the public need the protection of public officers.

The most common and dangerous of these contaminations is the presence of trichinæ in pork. We have two evils "to guard against—the danger to ourselves if trichinous meat is used, and the damage to our trade abroad if we do not suppress the exportation of such meat." To accomplish the latter object it will "be necessary to have every lot of bacon and ham packed for shipment abroad inspected for trichinæ by officers appointed for the purpose." "For ourselves in this country the danger is not so great, for we seldom eat our meat raw, as is so frequently the case abroad." Thorough cooking will kill trichinæ, and every part of the meat must be subjected to a temperature of at least 160° F. Merely warming the surface will not be sufficient, and no food prepared from pork should be eaten raw, unless it has been carefully examined for trichinæ.

Prof. Chester then gives an account of the development of the trichinæ and the means adopted for their detection. The *Trichina spiralis* is a minute worm, which in pork is found inclosed in a calcareous cyst. When meat containing these worms is eaten, the gastric juice dissolves the coating of lime, thus liberating the worm, which soon multiplies in myriads. The worm itself cannot be seen without the aid of a microscope or magnifying glass. Attention is called to a small instrument expressly devised for the microscopic examination of meat for trichinæ, and the use of the instrument is so simple that any one could employ it readily.

As the best and only remedy for this evil, it is suggested that the sale of trichinous meat be prohibited by law. The practice of feeding to pigs the offal of slaughtered animals is very justly condemned, and to it must be attributed, to a great extent, the spread of this parasitic contamination.

MEAT EXTRACTS.

"Since the discovery, by Baron Liebig, in 1857, of the extract which bears his name, a great number of such preparations have been put on the market, mainly for the use of invalids, their value depending on how nearly they approach the original in composition. Extract of meat, when properly

made, consists of those constituents of flesh which are soluble in hot water, the solution having been evaporated as much as possible for convenience in transportation. These soluble parts of meat include a number of obscure chemical substances—the value of which has not been accurately ascertained—and certain salts also found in the meat. The proteids, such as albumin and fibrin, are left out, not being soluble in hot water; and if the extract is well made the fat is entirely separated, having a tendency to turn rancid. The gelatin is also excluded as a useless incumbrance, carrying water, and so diluting the product."

"The materials composing the extract are not food in the ordinary sense, and ought never to be allowed to take its place, as is insisted upon by Liebig in all his articles on the subject. It is useful both as a nerve stimulant and as an adjunct to food proper. There are too many recorded cases of its usefulness in the first respect for any candid person to doubt it. It takes the place of alcoholic stimulant, and is often used in casss of extreme nervous exhaustion and prostration. It is of great value in the sick-room in cases of fever, when true food cannot be given. and yet it is necessary to stimulate the the vital forces. It is really nothing more nor less than a concentrated form of the best beef tea, and no one doubts the value of that. Yet there is a popular impression that ordinary beef tea is food, and many invalids are starved upon it when they ought to be nourished. Let it be distinctly understood that beef extracts, and equally beef tea, is not food if used alone. It is only a stimulant, and resembles tea and coffee in its effects. The nourishing parts of the meat have all been left out, and always will be when it is made with hot water. If beef juice is to be used as nourishment rather than stimulant, it should be extracted with cold water, the addition of a few drops of chlorohydric acid aiding much in the operation. Beef extracts contain part of the valuable constituents of the meat. If the muscle-producing parts were added you would then have true meat food. It is found, however, that these constituents, the albumenoids, can be added in the form of vegetable products, while the extractive matters can only be obtained from meat. This is Liebig's claim, and it seems to be borne out by all the facts. His belief was strong that the most valuable part of the meat is the extractive matter, since it cannot be obtained from any other source, hence its formula aims to leave out everything else. It is said by some, however, that an extract would be more valuable if it contained in addition the other parts of the meat and was in fact condensed meat. It is therefore claimed for some of the extracts sold that they contain all the valuable constituents of meat in a concentrated form, and are therefore true food, consequently of far greater value than Liebig's extract—much greater, in fact, than the amount of meat they are said to represent."

The following table gives the results of the analysis of several of these extracts:

	Water.	Organic Matter.	Ash.	Soluble Albumin.	Alcoholic Extract.
1. Liebig's Extract	18·27	58·48	23.25	0·05	44·11
2. Berger's Extract of Beef	40·65	39·85	19·50	1·11	13·18
3. Starr's Extract of Beef	37·00	55·65	7·35	1·10	10·13
4. Johnston's Fluid Beef	41·20	50·40	8·4	1·17	15·93
5. Grant's Beef Peptone	37·15	54·92	7·93	0·00	20·16
6. Valentine's Meat Juice	54·40	31·85	13·75	0·44	26·32
7. London Co.'s Extract of Beef	81·90	16·80	1·30	....	....
8. London Co.'s Essence of Mutton	78·00	19·50	2·50	....	....
9. London Co.'s Essence of Chicken	71·60	27·10	1·30	....	....

"Numbers two and three contain a larger amount of gelatin; number four contains a considerable amount of meat fibre in a very finely divided condition. Numbers seven, eight and nine are evidently just what they claim to be, extracts in hot water, much less concentrated than the others, and containing nothing to preserve them."

"From these analyses it will be seen that the principal difference between them is the amount of water that they contain; and in some cases there is a large amount of gelatin, useful in making soup, but not considered of great value as food. It is evident that the claim of making an extract equal in all

espects to fresh meat has not been carried out, and to use any of them as the sole food of an invalid vould be a great mistake."

These extracts are free from adulteration, "unless the presence of gelatin and an undue amount of vater can be so considered."

"Besides the various extracts of meat, there are in the market many extracts of fish, some of which are of considerable value." They are similar to meat extracts, but are not so pleasant in taste or of as great value.

Meat biscuit, composed of the extract, and albuminous and starchy matters, are manufactured to ome extent, and are of considerable value.

MEAT PRESERVES.

"There are three principal methods of preserving meat, by salting, smoking and canning. The first two methods do not add anything of a dangerous character to the meat, neither do they efficiently destroy any danger that may be hidden in it. Meat, unwholesome before, will not be wholesome after such treatment. Trichinæ will not be killed, and it is in meat so prepared that we will most often find this pest. But in canned meat there is the added chance that poisonous metallic impurities may get in by accident, as well as that other substances may be put in by design as adulterations."

Among the canned meats largely used in this country are beef, mutton, ham, tongue, turkey, chicken and corned beef, the last more than all the rest put together.

The danger of poisoning by metallic salts derived from the cans is considered to be generally overrated. To avoid the contamination in part, some manufacturers do not use lead solder. The use of what is called terne plate, containing lead, instead of pure tin plate, should be avoided.

Referring to the statement recently made by an English chemist, that nearly all canned meats and vegetables dissolve tin from the cans, and are dangerous to use in consequence, Prof. Chester questions the accuracy of these observations, and cites cases where canned foods are articles of every-day consumption without any injurious results following. Prof. Chester gives an instance of the placing of several cans of corned beef under a stump in the woods of Minnesota, as a temporary storehouse. They remained there five years, and when taken out the meat was found to be in perfect condition.

ISINGLASS AND GELATIN.

These substances are "identical in composition and uses, but the isinglass is decidedly the finer and more expensive product, and therefore gelatin is often substituted for it in whole or in part. Isinglass is more soluble in water than gelatin, and makes a cleaner and better jelly, and is said not to be so apt to disagree with the delicate stomach of an invalid. It has a slightly fishy smell, though not an unpleasant one, while gelatin has more or less the smell of glue." Four samples were examined, two of them being sold as isinglass and two as gelatin, but all proved to be samples of gelatin, those sold as such being of better quality and rather more expensive than those called isinglass.

(To be continued).

MILK ADULTERATION IN NEW JERSEY.

The following "Act to prevent the adulteration, and to regulate the sale of milk" (Chapter 82, Laws of 1882,) has recently been passed by the State of New Jersey.

1. BE IT ENACTED *by the Senate and General Assembly of the State of New Jersey*, That every person who shall sell, or who shall offer or expose for sale, or who shall transport or carry, or who shall have in possession with intent to sell or offer for sale, any milk from which the cream or any part thereof has been removed, shall distinctly, durably and permanently solder a label or tag of metal in a conspicuous place upon the outside and not more than six inches from the top of every can, vessel or package containing such milk, and such metal label or tag shall have the words "skimmed milk" stamped, indented or engraved thereon in letters not less than two inches in height, and such milk shall only be sold or shipped in, or retailed out of a can, vessel or package so marked.

2. *And be it enacted*, That every person who shall sell or who shall offer for sale, or who shall transport or carry for the purpose of sale, or who shall have in possession with intent to sell or offer for sale, any impure, adulterated or unwholesome milk, and every person who shall adulterate milk, or who shall keep cows for the production of milk in a crowded or unhealthy condition, or feed the same on food that produces impure, diseased or unwholesome milk, or shall feed cows on distillery waste, usually called swill, or upon any substance in a state of putrefaction or rottenness, or upon any substance of an unwholesome nature, shall be liable to the penalties hereinafter provided for in this act.

3. *And be it enacted*, That the addition of water or any other substance or thing is hereby declared an adulteration, and milk that is obtained from animals that are fed on distillery waste, usually called "swill," or upon any substance in a state of putrefaction or rottenness, or upon any substance of an unhealthful nature, or milk that has been exposed to or contaminated by the emanations, discharges or exhalation from persons sick with any contagious disease by which the health or life of any person may be endangered or compromised, is hereby declared to be impure and unwholesome.

4. *And be it enacted*, That in all prosecutions under this act, if the milk shall be shown, upon analysis by a member of the council of public analysts of this state, or the chemist of the state experiment station, to contain more than eighty-eight per centum of watery fluids, or to contain less than twelve per centum of milk solids, such milk shall be deemed for the purpose of this act to be adulterated.

5. *And be it enacted*, That every person who shall violate any of the provisions of this act shall be liable to a penalty of fifty dollars for the first offence and one hundred dollars for a second or subsequent offence.

6. *And be it enacted*, That justices of the peace and recorders shall have jurisdiction to try and punish all persons for violating the provisions of this act, and the penalties prescribed in section five of this act, for the violation of any of the provisions of this act, may be enforced before any justice of the peace or recorder in any county where the offence is committed, or where the offender is first apprehended.

7. *And be it enacted*, That said justice of the peace or recorder, upon receiving due proof, made before him by the affidavit of one or more persons, of the violation of any of the provisions of said act, by any person or persons, is hereby authorized and required by his warrant, under his hand and seal, directed to any constable or police officer of his county, to cause such person or persons to be arrested and brought before said justice or recorder, who shall hear and determine the guilt or innocence of the person or persons so charged, and upon conviction of said person or persons, the said justice or recorder is hereby authorized and required to impose upon the offender so convicted before him the penalties prescribed for such offences; and if any person so convicted shall fail to pay the penalty so imposed, together with the costs of the prosecution, the said justice or recorder is hereby authorized and required to commit such offender to the common jail of the said county for a period of not less than ten nor more than sixty days; *provided, however*, that an analysis of condemned milk shall be made by a member of the council of public analysts of this state, or the chemist of the state experiment station.

8. *And be it enacted*, That the certificate of any member of the council of public analysts or chemist of the state experiment station, given under his hand and seal, and sworn to and subscribed before any justice of the peace or notary public in this state, shall be taken and accepted as prima faciæ evidence.

9. *And be it enacted*, That the state board of health is hereby empowered and directed to appoint, each year, a competent person, who shall act as a state inspector of milk, at a salary of eight hundred dollars per annum, payable by the treasurer of this state, by warrant of the comptroller, in quarterly payments, for the purposes of this act, and in addition thereto said inspector shall be paid his actual travelling expenses while in the performance of his duties, and actual expenses of suits and costs of analyses brought by him under this act, payable by the treasurer of this state by warrant of the comptroller; said inspector shall act until removed by said board, or until his successor is appointed, and shall make such reports to said board, at such time as it may direct; said inspector, having reason to believe the provisions of this act are being violated, shall have power to open any can, vessel or package containing milk, whether sealed, locked or otherwise, or whether in transit or otherwise; and if, upon inspection, he shall find such can, vessel or package to contain any milk which has been adulterated, or from which the cream or any part thereof, has been removed, or which is sold, offered or exposed for sale, or held in possession with intent to sell or offer for sale, in violation of any section of this act said inspector is empowered and directed to take a sample of the same for analysis and put into a can, vessel or package, to be sealed in the presence of one or more witnesses, and sent to any member of council of public analysts or the chemist of the state experimental station, and also to condemn the same and

the contents of such can, vessel or package upon the ground or return the same to the consignor, and, if upon analysis such milk shall prove to be adulterated, shall bring suit against the person or party so violating the law; *provided, however*, that if upon analysis it is proved that the condemned milk is unadulterated, the state shall be liable for the value of the article destroyed, which shall be paid by the treasurer of this state, by warrant of the comptroller; and said inspector is empowered to employ one or more assistants, who shall have power to inspect milk as provided by this act, said assistants to be paid not less than five dollars per day for each and every day of actual service in performance of their duties, as provided by this act, payable by the treasurer of this state, by warrant of the comptroller.

10. *And be it enacted*, That all penalties imposed shall be paid into the treasury of this state, except in case the local board of health of any city, borough, town or township, shall prosecute the offender, in which case, the penalties shall be paid to the treasury of the city, borough, town or township so prosecuting; *provided*, that in prosecutions by the executive officer of any local board of health no expense shall be incurred to the state.

11. *And be it enacted*, That an act entitled "An act to prevent the adulteration of milk and to regulate the sale of milk," approved March twenty-second, one thousand eight hundred and eighty-one, and all other acts or parts of acts inconsistent with this act, be and the same are hereby repealed.

12. *And be it enacted*, That this act shall take effect immediately. Approved March fourteenth, one thousand eight hundred and eighty two.

ANALYST'S REPORT.

Dr. W. H. Ellis, public analyst for the district of Toronto, Canada, has issued his annual report on the adulteration of food. The largest proportion of adulteration was found in coffee and spices. Nine samples of the former article were examined, and three of them, including a sample obtained from a co-operative store, were pure; the remaining six contained chicory from 40 to 60 per cent. Eighteen samples of spices were tested, of which nine were pure. These were one sample of ginger, three of allspice, two of cloves, and three of pepper. One sample of cloves contained clove stalks, and another was adulterated with fifty per cent. of flour or turmeric. A sample of allspice was obtained by the analyst which contained 50 per cent. of peas. The three samples of cinnamon examined consisted of cassia or cassia and flour. Two samples of pepper which were adulterated contained flour from 10 to 15, and one 30 to 40 per cent. of wheat and peas, and 15 per cent. of sand. Of six samples of milk, two were watered, the others were unadulterated. Butter was found to be unadulterated. The candies were generally pure. Two specimens of aniseed berries were coloured with ferruginous pigments. Six samples of sugars were found to contain from 1·5 to 8·5 per cent. of glucose, four are described as pure with only a trace of glucose. Every sample of tea was "faced," but contained no foreign leaves. The samples of bread were unadulterated.

SAMPLES OF MILK WHICH HAVE FALLEN BELOW THE SOCIETY'S LIMIT.

In reference to the paper by Mr. W. Johnstone, F.I.C., F.C.S., which was read before the Society of Public Analysts on the 15th February, and was published in the March number of the Analyst, the Publication Committee think it desirable to state that it appears from some remarks made by Mr. Johnstone on the reading of his second paper on the same subject on the 28th June, that the analyses were made by coagulating the milk with acetic acid and, after drying the residue, extracting the fat in the Soxhlet apparatus. The statement of this process having been used, was omitted from the paper in question, and may possibly cause the results obtained to differ from the Society's limit.

ANOTHER LARD ADULTERANT.

A correspondent of a contemporary, writing from New York says:—It leaked out the other day that cocoanut oil is being used to debase lard. It can be used to the extent of 10 to 12 per cent. A French chemist in this city claims to be able to deodorise it, but the best sample he submitted, your correspondent examined without knowing what it was, but, supposing it to be lard, he readily detected the flavour of cocoanut oil. Several thousand pounds were a part of the assets of a lard refining firm that failed not long since. We doubt if it is extensively used, for we find that very few of the dealers on the Produce Exchange were aware of this new adulterant.

RECENT CHEMICAL PATENTS.

The following specifications have been recently published, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

No. 1881	Name of Patentee.	Title of Patent.	Price
4571	E. G. Brewer	Measurement of Electricity in Distribution Systems	6d.
4577	P. Jensen	Treatment of Iron for Removal of Phosphorous, Sulphur, &c.	6d.
4664	J. Imray	Electrometers	2d.
4654	C. G. André	Electric Incandescent Lamps	6d.
4702	J. Young	Manufacture of Sulphate of Lime	2d.
4719	A. and M. Conroy	Treatment of Malt to Produce an Article of Diet to be Used as a Substitute for Coffee	2d.
4775	H. A. Bonneville	Electric Lamps	4d.
4743	E. G. Brewer	Preservation of Milk	6d.
4744	E. Edwards	Extracting Grease and Fat from Bones	6d.
4777	E. R. Prentice	Electric Lamps	2d.
4778	F. Wright	Electric Lamps	2d.
4792	W. E. Hubble	Apparatus for Closing the Circuit on the Extinction of an Electric Lamp	6d.
4854	J. B. Rogers	Production, &c. for Electricity for Lighting Purposes	2d.
4857	J. B. Rogers	Electric Lamps	6d.
4888	T. Richters	Manufacture of Sulphuric Acid	4d.
4915	E. Edwards	Preparation of Farinaceous Food to be Used as a Substitute for Coffee	2d.
4936	W. R. Lake	Extracting Glycerine, Oileine, &c. from Various Substances	4d.
4942	S. Pitt	Applying Electric Currents in the Production of Light	6d.
5185	E. G. Brewer	Electric Lamps	1s.

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; Journal of Applied Science; The Provisioner; The Practitioner; New Remedies; Proceedings of the American Chemical Society; Le Practicien; The Inventors' Record; New York Public Health; The Scientific American; Society of Arts Journal; Sanitary Engineer of New York; The Chemists' Journal; Oil and Drug News; Sugar Cane; Country Brewers' Gazette; The Medical Record; Oil and Drug Journal; The Canada Lancet; Gas and Water Engineering; The Grocers' Gazette; Columbia School of Mines Quarterly Magazine; London Water Supply, by Crookes, Odling and Tyid; Catalogue of Massachusetts College of Pharmacy, 1882-3; Chicago Chemical Review; Manual of Colours and Dye Wares, by J. W. Slater; Report of the Smithsonian Institution, Washington 1880; New York Shoe and Leather Manufacturer.

∴ We regret that want of space has compelled us to defer until next month notices of several books we have now before us for review.—Ed. Analyst.

THE ANALYST.

AUGUST, 1882.

ON THE RELATION BETWEEN THE SPECIFIC GRAVITY, THE FAT, AND THE SOLIDS NOT FAT IN MILK.

By Otto Hehner, F.C.S., F.I.C.

Read before the Society of Public Analysts on 28th June, 1882.

The specific gravity of milk is in the main a function of two factors: namely, of the percentage of solids not fat and of that of the fat. Whilst the former raises the specific gravity of milk above that of water, the latter, being lighter than water, acts in the opposite direction.

Taken by itself, the specific gravity affords but very little indication of the composition of any given sample of milk, for an infinite number of mixtures of solids not fat and of fat can be imagined giving the same specific gravity; but if any other item in the analysis be furnished, such as the amount of fat, of solids not fat, or of total solids, it should be possible to find by calculation the other unknown quantities, provided always that the specific gravity due to fat and to solids not fat is in direct proportion to the percentage of these constituents. For the fat this is well known to be the case, for we utilise the comparative constancy in the specific gravity of butter fat in judging of the purity of butter, but for the solids not fat this is by no means a matter of course, for they themselves are made up of a number of different constituents in fluctuating relative proportions and of different gravities. It was the object of the investigation forming the matter of this paper to ascertain whether the specific gravity of the solids not fat was sufficiently constant to be capable of being utilised in milk analysis.

If each percentage of solids not fat, S, raise the specific gravity, G, of milk above 1,000 to the amount s, and if each percentage of fat F depress the gravity by the quantity f, then

(1) $S\,s - F\,f = G$. We have also

(2) $F + S = T$ (Total Solids).

Substituting in the first equation for F its value T — S (obtained from 2) we obtain $S\,s - (T - S)\,f = G$, from which

$$S\,s - T\,f + S\,f = G, \text{ and}$$

$$S\,s + S\,f = G + T\,f, \text{ and lastly}$$

$$S = \frac{G + T\,f}{s + f}$$

That is to say, we would obtain the percentage of solids not fat by adding to the specific gravity of the milk—by which term throughout this paper I understand that figure by which 1,000 volumes of milk are heavier than an equal bulk of water—the percentage of total solids multiplied by the gravity of each percentage of fat, the sum being divided by the sum of the gravities of one per cent. of solids not fat and of fat.

If we determined, then, the specific gravity and the percentage of total solids, the above formula would furnish us with the percentage of solids not fat, and by difference, of the fat, provided the factors s and f be known. Milk analysis, for the purposes of the Public Analyst would then be reduced to two very simple operations, the extraction of the fat being entirely avoided. Or we would at least have a most valuable check upon our analytical results, even if the ordinary determinations were made as heretofore.

Behrend and Morgen (*Journal fur Landwirthschaft*, 1879) have published a table which purports to give the percentage of total solids for the specific gravities from 1025 to 1040, the percentage of fat being known. The fundamental analyses were, however, made by these authors by means of methods very different from those employed by English Public Analysts, and their results are generally very far off the figures obtained by our usual method of milk analysis, as will be seen from instances given further on. Their whole method of operating being different from our own, the results are hardly comparable.

Clausnitzer and Mayer (*Forschungen auf dem Gebiete der Viehaltung* 1879, 265) have worked out a formula very similar to the one given above. They state that the amount of fat is obtained by multiplying the percentage of total solids by 0·789, and subtracting from the product the specific gravity minus one, divided by 0·00475. The factors used in this formula are based upon the supposition that each per cent. of fat decreases the specific gravity by 1·0, whilst each per cent. of solids not fat increases it by 3·75.

Now if the specific gravity of butter fat at 15·5° C. were 900, one per cent. of butter fat would cause a depression in the gravity of 1·0. But we know most certainly that the specific gravity of butter fat at 15·5° *is not* 900, but about 927·5. This is the figure found by Mr. Wynter Blyth (ANALYST, Vol. V., p. 76) as the result of direct experiment, and in close agreement with it, namely 928·3 is the gravity which can be calculated from Mr. Wigner's Table on the Ratio of Expansion of Butter Fat (ANALYST, 1879, p. 184). The depression in specific gravity is therefore not 1, but only 0·725 for each per cent. of fat. The difference between these two figures is a serious one, and Clausnitzer and Mayer's formula must therefore be rejected as incapable of giving reliable results.

As Clausnitzer and Mayer's factors are calculated from the results of numerous analyses, it follows, as their factor for the minus gravity of the fat is too high, that their figure for the plus gravity of the solids not fat is also too high. These two errors may, and as will be seen from the results given below, frequently do, counterbalance each other, yet when the ordinary balance between the different milk constituents is disturbed, the calculated results differ materially from those found by experiment.

To ascertain the factor s, I have made a series of analyses of milk, bestowing the utmost care upon every step. In all cases about 5 grammes were evaporated, the residue dried for *at least* four hours in the water oven, and after weighing extracted for *at least* two hours in a Soxhlett tube with pure ether, the exhausted residue being again dried at 100° for one hour. I have previously shown that under these conditions variations in the results are reduced to a minimum.

The specific gravity was also determined with the greatest possible accuracy. I found t much better results were obtained by means of a Sprengel tube (*Chem. Soc. Journ.* 11, p. 577) holding about ten grms., than by the use of the specific gravity bottle. tremely minute air bubbles remain suspended in milk for a considerable time after its ng shaken, and these are hardly visible in a specific gravity bottle, but readily so in the illaries of the Sprengel tube, from which they can be removed without difficulty. A stant temperature can much more rapidly be obtained by suspending the tube in a ker of water kept at 15·5°C. than in a bottle, and hence fat globules have much less nce to rise during the experiment. I found it best to operate as follows. The sample vell shaken and poured out into a shallow dish. The wider end of the Sprengel tube is n inserted to the very bottom of the basin, and is filled by sucking at the narrower illary. When full, a few drops of the milk are again blown out and the tube is again npletely filled, this alternate blowing and filling being repeated, any air bubbles which be in the tube being thus removed. The tube is then suspended in a large beaker d with water at 15·5°, and allowed to remain for two or three minutes. The meniscus he milk in the wider capillary will then be found to be absolutely constant; the excess luid is then removed to the mark on the tube. Weighings thus obtained never differ e, and generally less than one milligram from each other.

The Sprengel specific gravity tube has hardly been employed by analysts as frequently t deserves to be. It is altogether an instrument vastly superior in every respect to the inary specific gravity bottle.

The following results were in this manner arrived at; they are from successive analyses taken without selection.

p. Gr.	Tot. Sol.	Fat.	Sol. n. f. found.	S. n. f. calc.	S. n. f. C. & M.	S. n f. B. & M.
31·91	13·03	3·62	9·41	9·55	9·46	8·8
29·35	11·11	2·49	8·62	8·64	8·52	—
30·34	13·24	4·12	9·12	9·22	9·17	—
31·14	13·65	3·90	9·75	9·48	9·43	—
31·04	11·19	2·17	9·02	9·04	8·89	8·4
32·06	13·07	3·68	9·39	9·59	9·50	—
32·25	12·58	2·82	9·76	9·56	9·44	—
28·68	10·57	2·14	8·43	8·38	8·25	—
28·76	15·39	6·32	9·07	9·22	9·29	—
33·89	11·59	1·60	9·99	9·77	9·57	9·1
30·59	11·15	2·03	9·12	8·93	8·79	—
28·71	11·13	2·54	8·59	8·49	8·38	—
29·54	10·63	1·89	8·74	8·60	8·25	—
24·12	11·03	2·72	8·31	7·41	7·04	—
28·98	10·83	2·14	8·69	8·50	8·38	7·9
36·20	10·79	0·73	10·06	10·17	9·88	—
30·50	13·74	4·53	9·21	9·34	9·31	—
31·84	12·37	3·02	9·35	9·42	9·30	—
29·61	10·64	2·07	8·57	8·62	8·47	7·9
20·42	15·45	8·31	7·24	7·30	7·55	—
29·44	11·97	3·25	8·72	8·80	8·72	—
30·15	11·16	2·35	8·81	8·83	8·69	8·2
			AVERAGE.			
29·98	12·10	3·15	8·95			

Taking the average of the above 22 analyses we get 29·98+3·15· 0·725=8·95 s or ·605, that is to say, each per cent. of solids not fat raises on the average the gravity ne milk by 3·605.

From this factor I have calculated from the specific gravity and the percentage of total solids the theoretical amount of solids not fat which will be found in column 5, and in juxtaposition with it the theoretical amounts calculated from Clausnitzer and Mayer's formula. I also give, in column 7, a few of the results obtained from Behrend and Morgen's table.

It will be seen that the agreement between the figures of columns 4 and 5 is throughout very fairly satisfactory. In 14 cases is the calculated amount above that found, the greatest difference being 0·20 per cent., and the average *plus* error 0·09 per cent. In 8 cases are the calculated results lower than the experimental ones, the highest *minus* error being 0·27.

While, therefore, it follows that the specific gravity of the solids not fat is not an absolutely constant quantity, it is yet conclusively established that any variations are very inconsiderable and without material influence upon the calculated results. Even in samples most widely differing from each other, such as skim milk, and in milk extraordinarily rich in fat, the factor 3·605 holds good, proof being by that circumstance furnished of the accuracy of both the fat factor and of that for the solids not fat.

If Mayer and Clausnitzer's calculated results are now examined it is seen that in many cases the agreement is very good, but that in others the differences are very considerable. In one case the results entirely coincide; in 6 there is a *plus* error, the greatest being 0·31, and the average *plus* error 0·12. In 15 cases the calculated result is too low, the difference varying between 0·05 and 0·49 per cent., the average *minus* error being 0·24 per cent. As was to be expected, the greatest discrepancies occur with the samples poorest in fat, because in these the error is chiefly in one direction, the divisor in the formula being too large, and hence the results too low.

Lastly, Behrend and Morgan's table always gives results much too low and quite useless for analytical purposes.

I think then, that I have established the fact, *that by multiplying the total solids by* 0·725, *adding the product to the specific gravity, and dividing the same by* 4·33 *(s+f), we obtain the percentage of solids not fat with a satisfactory approach to accuracy, provided the exact conditions as to drying the solids and taking the gravity are observed, which were followed in the fundamental analyses.* A difference of 0·1 in the gravity causes a difference in the calculated results of 0·023 per cent., and a difference of 0·1 per cent. of total solids, 0·017 per cent. in the solids not fat. With care, therefore, the error should not be greater than + 0·04 per cent.

If, from the specific gravity and the total solids, calculation furnishes a satisfactory amount of fat and of solids not fat, I think the usual extraction with ether may safely be dispensed with, the only further determination desirable being that of the ash. But, if the calculated results are below the limits of genuine milk, I would extract with ether, thus obtaining definite and final information as to the quality of the sample. As the majority of the samples analysed is genuine, much labour and time will be saved without loss in accuracy. In adulterated samples, on the other hand, we would have a valuable and desirable check upon the analytical figures obtained.

From the formula above given, the following tables are calculated. They show for the ordinary range of specific gravity and total solids the percentage of solids not fat.

SOLIDS NOT FAT, CALCULATED FROM SPECIFIC GRAVITY AND TOTAL SOLIDS.

	11·0	·2	·4	·6	·8	12·0	·2	·4	·6	·8	13·0	·2	·4	·6	·8	14·0	·2	·4	·6	·8
1029·0	8·54	8·57	8·61	8·64	8·67	8·70	8·74	8·77	8·80	8·84	8·87	8·90	8·94	8·97	9·00	9·03	9·07	9·10	9·13	9·17
2	8·59	8·62	8·66	8·69	8·70	8·73	8·77	8·80	8·83	8·87	8·90	8·93	8·97	9·00	9·03	9·06	9·10	9·13	9·16	9·20
4	8·63	8·66	8·70	8·73	8·76	8·79	8·83	8·86	8·89	8·93	8·96	8·99	9·03	9·06	9·09	9·12	9·16	9·19	9·22	9·26
6	8·68	8·71	8·75	8·78	8·81	8·85	8·89	8·91	8·94	8·98	9·01	9·04	9·08	9·11	9·14	9·17	9·21	9·24	9·27	9·31
8	8·72	8·75	8·79	8·82	8·85	8·88	8·92	8·95	8·98	9·02	9·05	9·08	9·12	9·15	9·18	9·21	9·25	9·28	9·31	9·35
1030·0	8·77	8·80	8·84	8·87	8·90	8·93	8·97	9·00	9·03	9·07	9·10	9·13	9·17	9·20	9·23	9·26	9·30	9·33	9·36	9·39
2	8·82	8·85	8·89	8·92	8·95	8·98	9·02	9·05	9·08	9·12	9·15	9·18	9·22	9·25	9·28	9·31	9·35	9·38	9·41	9·45
4	8·86	8·89	8·93	8·96	8·99	9·02	9·06	9·09	9·12	9·16	9·19	9·22	9·26	9·29	9·32	9·35	9·39	9·42	9·45	9·49
6	8·91	8·94	8·98	9·01	9·04	9·07	9·11	9·14	9·17	9·21	9·24	9·27	9·31	9·34	9·37	9·40	9·44	9·47	9·50	9·54
8	8·95	8·98	9·02	9·05	9·08	9·11	9·15	9·18	9·21	9·25	9·28	9·31	9·35	9·38	9·41	9·44	9·48	9·51	9·54	9·58
1031·0	9·00	9·04	9·07	9·10	9·13	9·16	9·20	9·23	9·26	9·30	9·33	9·36	9·40	9·43	9·46	9.49	9·53	9·56	9·59	9·63
2	9·05	9·09	9·12	9·15	9·18	9·21	9·25	9·28	9·31	9.35	9·38	9·41	9·45	9·48	9·51	9·54	9·58	9·61	9·64	9·68
4	9·09	9·13	9·16	9·19	9·22	9·25	9·29	9·32	9·35	9·39	9·42	9·45	9·49	9·52	9·55	9·58	9·62	9·65	9·68	9.72
6	9·14	9·18	9·21	9·24	9·27	9·30	9·34	9·37	9·40	9·44	9·47	9·50	9·54	9·57	9·60	9·63	9·67	9·70	9·73	9·77
8	9·18	9·22	9·25	9·28	9·31	9·34	9·38	9·41	9·44	9·48	9·51	9·54	9·58	9·61	9·64	9·67	9·71	9·74	9·77	9·81
1032·0	9·23	9·27	9·30	9·33	9·36	9·39	9·43	9·46	9·49	9·53	9·56	9·59	9·63	9·66	9·69	9·72	9·76	9·79	9·82	9·86
2	9·28	9·32	9·35	9·38	9·41	9·44	9·48	9·51	9·54	9·58	9·61	9·64	9·68	9·71	9·74	9·77	9·81	9·84	9·87	9·91
4	9·33	9·37	9·40	9·43	9·46	9·49	9·53	9·56	9·59	9·63	9·66	9·69	9·73	9·76	9·79	9·82	9·86	9·89	9·92	9·96
6	9·37	9·41	9·44	9·47	9·50	9·53	9·57	9·60	9·63	9·67	9·70	9·73	9·77	9·80	9·83	9·86	9·90	9·93	9·96	10·00
8	9·42	9·45	9·49	9·52	9·55	9·58	9·62	9·65	9·68	9·72	9·75	9·78	9·82	9·85	9·88	9·91	9·95	9·98	10·01	10·05
1033·0	9·47	9·50	9·54	9·57	9·60	9·63	9·67	9·70	9·73	9·77	9·80	9·83	9·87	9·90	9·93	9·96	10·00	10·03	10·06	10·10
2	9·51	9·54	9·58	9·61	9·64	9·67	9·71	9·74	9·77	9·81	9·84	9·87	9·91	9·94	9·97	10·00	10·04	10·07	10·10	10·14
4	9·56	9·59	9·63	9·66	9·69	9·72	9·76	9·79	9·82	9·86	9·90	9·92	9·96	9·99	10·02	10·05	10·09	10·12	10.15	10·19
6	9·60	9·63	9·67	9·70	9·73	9·76	9·80	9·83	9·86	9·90	9·94	9·96	10·00	10·03	10·06	10·09	10·13	10·16	10·19	10·23
8	9·65	9·68	9·72	9·75	9·78	9·81	9·85	9·88	9·91	9·95	9·99	10·01	10·05	10·08	10·11	10·14	10·18	10·21	10·24	10·28

Dr. Muter said that Mr. Hehner's paper was a most interesting research, and would be very useful, besides being of scientific interest in enabling an analyst to check the work of his assistants, because it seemed to him that if the sp. gr. and the total solids were obtained, one got very nearly what the other figures ought to be.

Dr. Vieth said he quite agreed there was a great relation between the sp. gr. and the total solids and the fat. He had calculated very many samples by the table drawn up by Behrend and Morgan, but very seldom found that the difference was more than ·2 per cent. In about 80 per cent. of all the analyses the difference was less than ·2 per cent. He did not think it would be advisable to do away altogether with extracting the fat, but it was very important to have such a check upon the analysis, and to be able to calculate the fat before extracting it. For merely controlling the milk such a calculation would suffice, and ether—the most expensive reagent in milk analysis—saved; and thus, by saving time and expense, it might perhaps be possible to charge for a milk analysis less than two guineas, a price which is charged by some Public Analysts in London.

Dr. Dupré said that many years ago he worked out a process for estimating the solids in wine, and found that, although the solids varied very widely, the influence they exerted on the sp. gr. did not vary much except in the case of the ash, and he found it necessary, in order to get a close agreement, that he should always estimate the ash, and make a special allowance for that, taking the sp. gr., calculating the total solids, and subtracting the amount of ash, because the ash always influenced the sp. gr. about twice as much as the rest. In the case of milk, Dr. Dupré said he thought it must be somewhat similar. With regard to butter fat it did not at all follow that the sp. gr. of that was the same before as after it had been extracted. He might say that he invariably rejected a milk if there was not some very close relation between the sp. gr., total solids, and the fat taken into consideration.

Mr. Wynter Blyth was pleased to hear this paper read. At a recent meeting he had said he had made a great number of determinations, and had found the calculated amount of fat remarkably accurate, on which Mr. Hehner said that he had used a wrong formula for the fat, but he thought as Dr. Dupré had just put it, that they had no proof that the sp. gr. of the milk fat in the milk, was the same as when it was in the form of butter. He remembered a paper by Mr. Wanklyn, which appeared in the *Philosophical Magazine*, in which it was stated that there might be two or three sp. grs. of the same milk under different conditions. He was not yet convinced of the truth of these factors. They must all work at this subject. He had the sp. gr. taken of every milk that he analysed, and compared the amount of fat and the total solids. His general results agreed with Mr. Hehner's, but a very rich milk gave results which did not agree, and so did a very poor milk. For ordinary milks, however, he found them agree pretty closely. He supported it as a technical process as being a very useful thing for them to adopt. In the case of milks, which from their total solids were certain not to be adulterated, he merely took the sp. gr., total solids, and ash, but did not trouble to take the fat; if the milks were not genuine he took the fat accurately, and checked the results by means of a table; he found this table very useful indeed, and worth while to be worked out in a great many laboratories in order to get at the real truth of it. In some cases the calculated results would be inaccurate, but still if they were accurate in the majority of instances, it would be something. They must, however, be careful not to

shirk their work, as it were, by a sort of analytical dodge, and should only use the formula in those cases where it was impossible from the analytical data that the samples could be other than genuine milks.

Mr. Hehner, in reply, pointed out that a milk, when adulterated with sugar or glycerine, would show a considerable difference between the solids not fat calculated and found, and if such a difference were observed, the analyst would at once be put on the alert and search for the cause. As regarded the correction for the ash, the amount of ash in milk was so constant that he did not think it worth while to make the correction. In wine it was no doubt an object of importance, but in milk it was not so. As to the sp. gr. of fat liquid and solid it was, of course, quite possible that there was such a difference as that stated, but it could certainly be only small. In conclusion, Mr. Hehner said that he could not insist upon it too strongly—that if analysts were going to judge of the merits of his proposal at all, the processes must be carried out exactly as he had described.

NOTE ON THE USE OF PLATINIC CHLORIDE AS AN INDICATOR IN THE DETERMINATION OF FREE IODINE.

By T. P. Blunt. M.A., F.C.S.

Read before the Society of Public Analysts, on 28th June, 1882.

It is well known that on adding solution of platinic chloride to potassium iodide, an intense red-brown colour is produced, this is instantly destroyed by an excess of sodium hyposulphite, and the reaction may be used with advantage in the place of the blue colour of filtered starch solution in the determination of iodine with hyposulphite.

The following has been found to be the best method of procedure in the case of the determination of oxygen absorbed in course of a water analysis :—A 1 per cent. solution of platinic chloride is prepared, and three measured grains of it are added to the usual quantity of potassium iodide used for destroying the excess of permanganate, a little of the standard hyposulphite is added from the burette until the colour is just destroyed, leaving only the clear yellow of the platinum salt; the operation is conveniently conducted in a test-tube, the mixture is now added to the water containing the permanganate, and the titration carried out as usual. The colour at first is a warm purplish-brown, but as the reaction approaches its conclusion the tint changes to purple, which at last disappears entirely with perfect sharpness, leaving only a very faint yellow tinge, which it is impossible to confuse with the characteristic colour of the iodine compound. I think anyone who gives this modification a fair trial will use it in preference to the common one, with filtered starch solution, a reagent somewhat troublesome to prepare and exceedingly unstable. One very annoying characteristic of the starch solution is that after a short time it acquires the property of itself liberating iodine, and turning blue immediately on the mere addition of pure potassium iodide and sulphuric acid. The change does not appear to be due to organisms, for it occurs when the solution has been plugged with cotton wool while boiling, and after prolonged ebullition, in a test-tube.

PREPARATION OF NITRO-GLYCERINE.

Boutmy & Foucher have recently been awarded by the French Academy of Sciences the prize of 2,500 francs for their new and safe method of the preparation of nitro-glycerine. The process consists in combining the glycerine with the sulphuric acid so as to form the glycero-sulphuric acid, and decomposing the latter, slowly, by means of nitric acid. Two solutions are thus prepared: the glycero-sulphuric acid and the sulpho-nitric acid, the latter being formed by the mixture of equal parts of sulphuric and nitric acid. These mixtures give rise to the emission of a large amount of heat, which necessitates the employment of refrigerating mixtures. In finally mixing these acids in convenient proportions, a reaction is produced which continues about twenty minutes. The nitro-glycerine is deposited at the bottom of the vessel, and may be readily collected and washed. According to the old process, the reaction was rapidly accomplished, and a portion of the nitro-glycerine arose to the surface, which rendered the operation of washing difficult.—*Oil and Drug News.*

NOTE ON THE ESTIMATION OF FAT BY CLAUSNIZER AND MAYER'S FORMULA.

By A. Wynter Blyth, M.R.C.S.

In 41 samples of milk derived from various sources, and fairly representing the average supply, the formula was tested by the following procedure:—10 grammes of milk were evaporated in the usual way by exposure on the water-bath for from three to four hours; afte weighing the residue, the dish was treated with dry ether, and the fat weighed directly and also estimated by difference. The specific gravity was taken in an ordinary 50 gramme specific gravity bottle; from the specific gravity and from the total solids, the amount of fat was calculated by the formula and the results compared. The following is a summary:—

In 3 out of the 41 cases, correct to the second decimal place.

In 19 or 46·3 per cent., correct to the first place.

In 13 out of the 38 cases, the error was plus; that is, the fat was over-estimated and ranged from ·01 to ·38, the mean being ·11.

In 25 out of the 38 cases, the error was minus; that is, the fat was returned too low. The range was from ·01 to ·39, the mean being ·13.

I trust that other analysts will follow the matter up and publish abstracts of their results, for it seems that the method is likely to be very useful; and at all events, sufficiently accurate in a majority of instances for technical work.

As to the correctness of the formula, that formula will survive which gives the best results.

ANALYSTS OF THE NEW YORK STATE BOARD OF HEALTH.

At the meeting of the New York State Board of Health, held in Albany on the 9th of May, the following-named gentlemen were elected Analysts for the ensuing year. Samuel A. Lattimore, P Rochester; Willis G. Tucker, Ph.D., Albany; Drs. Frederick Hoffman and J. G. Love, of New Yor

AMERICAN CHEESE.

By P. Vieth, Ph.D., F.C.S.

Some weeks ago I had the opportunity of analysing two specimens of American cheese. This cheese was stated to have been made of skim milk with addition of foreign fat, the one containing lard, the other oleomargarin. The appearance of both cheeses was that of Cheddar, one was very high coloured; they were very well prepared and tasted not at all bad, the lard cheese, however, having a somewhat peculiar flavour.

The result of the analyses were as follows:—

CHEESE CONTAINING LARD.

Water	38·26 per cent.
Fatty Matters	21·07 " "
Casein, &c.	35·55 " "
Mineral Matters	5·12 " "
	100·00

CHEESE CONTAINING OLEO-MARGARIN.

Water	37·99 per cent.
Fatty Matters	23·70 " "
Casein, &c.	34·65 " "
Mineral Matters	3·66 " "
	100·00

I extracted the fat from a large quantity of cheese and determined the insoluble fatty acids with the following results:—

FAT OF CHEESE CONTAINING LARD.

Insoluble Fatty Acids	90·46 per cent.
Butter Fat	·63 " "
Foreign Fat	·37 " "

FAT OF CHEESE CONTAINING OLEOMARGARIN.

Insoluble Fatty Acids	91·82 per cent.
Butter Fat	·46 " "
Foreign Fat	·54 " "

There was about 1·25 and 1 per cent. of butter fat left in the skim milk used for making the cheeses.

As the butter fat takes the highest price if sold in the form of butter, and as it can be replaced in cheese without prejudice to a certain extent; as further, such a cheese, if carefully prepared, is very little more expensive and much better than cheese made entirely of skim milk, I do not see any objection against those artificial fat cheeses. Of course, they must be sold as what they really are, and security ought to be given that only the fat of sound animals is used, and that it is prepared for the purpose in a clean and unobjectionable way.

POISONING FROM CANNED FOOD.

At a recent meeting of the Chicago Medical Society, Dr. S. I. Avery reported several cases of poisoning in a family from eating of canned sardines. Dr. Bartlett reported similar cases from eating pressed corned beef. Dr. Tilley reported cases of poisoning from eating bluefish. Dr. W. H. Curtis attributed the poisoning in such cases to the presence of a peculiar ferment in the food eaten. Dr. Ingals considered that the fault might lie with the food before canning.—*Chicago Medical Review.*

SOCIETY OF PUBLIC ANALYSTS.

Analyses of English Public Water Supplies in July, 1882. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Date when drawn.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine in Chlorides.	Phosphoric Acid in Phosphates.	Nitrogen in Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in		Hardness, Clark's Scale, in degrees.		Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
									15 mins. at 80° Fahr.	4 hours at 80° Fahr.	Before Boiling.	After Boiling.			
Kent Co.	July 12	c. green blue	none	1·85	none	·13	·0041	·0062	none	·006	20·0°	4·4°	32·2	satisfactory	Wigner & Harland.
New River	" 17	clear	none	1·15	trace	·16	·0014	·0014	·008	·018	13·5°	3·0°	18·2	satisfactory	B. Dyer.
East London ..	" 8	c. yell. green	none	1·35	none	·08	·0010	·0012	none	·014	13·6°	3·2°	23·0	vegetable debris	Wigner & Harland.
Southwark & Vauxhall ..	" 12	c. pale yell.	none	1·24	trace	·13	·0007	·0070	·048	·087	15·0°	4·0°	18·9	satisfactory	John Muter.
West Middlesex	" 25	yell. green	none	1·01	trace	·12	·0021	·0097	·046	·095	12·0°	3·5°	18·5	satisfactory	O. Hehner.
Grand Junction	"	p. yellow		1·04	trace	·20	·0002	·0058	·008	·094	14·1°	3·5°	20·3		A. Wynter-Blyth.
Lambeth	" 12	c. pale yell.	none	1·24	trace	·13	·0007	·0070	·046	·087	15·0°	4·0°	21·0	satisfactory	John Muter.
Chelsea	" 28	v. p. brown	none	1·19	trace	·11	none	·0036	·031	·070	14·5°	5·0°	19·4		A. Dupré.
Birmingham ..	July 11	v. turb. grnsh.	none	1·19	trace	·03	·0014		·063	·159	11·9°	5·4°	16·5	veg. & animal organisms	A. Hill.
Bolton	" 14	clear	none	·48	none	·03	·0014	·0058	·003	·020	3·6°	3·4°	7·7	satisfactory	W. H. Watson.
Brighton	" 9	c. p. blue	none	1·91	none	·25	·0016	·0019	none	none	12·4°	3·9°	20·6	vegetable debris	Wigner & Harland.
Bristol	" 3	p. green brown	none	·80	trace	·23	·0010	·0050	·027	·080	13·0°	3·6°	16·8	sand, algæ	F. W. Stoddart.
Broadstairs	" 25	p. blue clear	none	8·07	trace	·34	·0043	·0068	·008	·010	18·4°	5·9°	34·8	satisfactory	Wigner & Harland.
Cambridge	" 18	c. p. blue	none	1·40	trace	·38	·0005	·0020	none	·013	17·5°	5·5°	25·0	satisfactory	J. West Knights.
Croydon	" 20	colourless	none	1·19	trace	·29	none	·0040	none	·010	15·5°	6·0°	22·8	satisfactory	C. Heisch.
Edinburgh	" 15	s. brown	none	·88	none	trace	·0024	·0072	·016	·022	3·9°	3·7°	5·2	none	J. Falconer King.
Exeter, unfiltrd.	" 6	f. green yell.		·84	trace	·23	·0007	·0058	·051	·014	2·5°	2·5°	6·3		F. P. Perkins.
Exeter, filtered	" 6	f. green yell.		·84	trace	·21	none	·0039	·019	·039	2·7°	2·7°	5·6		F. P. Perkins.
Liverpool	" 10	s. green	none	1·15	trace	·06	·0007	·0021	·019	·061	4·2°	4·0°	10·0		A. Smethr

SOCIETY OF PUBLIC ANALYSTS.

Analyses of English Public Water Supplies in July, 1882. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Date when drawn.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine in Chlorides.	Phosphoric Acid in Phosphates.	Nitrogen in Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in 15 mins. at 80° Fahr.	Oxygen, Absorbed in 4 hours at 80° Fahr.	Hardness, Clark's Scale, in degrees. Before Boiling.	Hardness, Clark's Scale, in degrees. After Boiling.	Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
Maidstone—															
Wtr. Company	July 14	p. green	none	2·60	trace	·75		·0014	·030	·061	23·4°	7·0°	34·0	none	M. A. Adams.
Public Conduit	„ 14	p. blue		2·30	trace	·71		·0009	·020	·027	22·2°	6·7°	33·0	none	M. A. Adams.
Manchester	„ 11	c. f. yellow	none	·73	none	none	·0024	·0056	·041	·072	1·7°	1·6°	5·0	vegetable mtr.	W. Thomson.
Norwich	„ 6	p. grnsh. yell.	none	1·90	trace	·06	traces	·0076	·049	·054	12·5°	3·9°	16·0	satisfactory	W. G. Crook.
Nottingham ..	„ 9	c. grnsh. blue	none	1·27	none	1·45	traces	·0017	·008	·012	11·2°	6·6°	22·2	trace veg. matter	Wigner & Harland.
Portsmouth ..	„ 12	clear	none	1·20	trace	·16	trace	·0056			13·0°	2·0°	18·2	veg. deb., diatoms	W. J. Sykes.
Rugby	„ 4	c. p. yellow	none	1·04	h. trace	·12	·008	·0132	·051	·100	16·0°	7·5°	20·0	veg. deb., diatoms	A. P. Smith.
Salford	„ 19	s. cloudy	none	·70	none	none	·0007	·0017	·002	·024	2·5°	2·0°	4·5		J. Carter Bell.
Shrewsbury ..	„ 8	c. colourless	none	1·45	none	·33	·0010	·0025	·007	·007	21·0°	6·0°	26·0	none	W. Morgan.
Swansea	„ 21	clear	none	1·00	trace	none	·0010	·0049	·003	·004	1·4°	1·4°	4·2	none	T. P. Blunt.
Whitehaven ..	„ 21	c. f. green	none	·43	trace	·01	none	·0008	·010	·024	·4°	·4°	2·3	veg. deb., diatoms	A. Kitchin.

Abbreviations:—c., clear; f., faint h., heavy; p., pale; v. h., very heavy v. s., very slight.

SAMPLES RECEIVED AND ANALYSED IN THE MUNICIPAL LABORATORY, PARIS, DURING THE MONTH OF JUNE, 1882.

We have been favoured with the following from a Paris correspondent, and print it for the information of our readers.

SAMPLES.	Bought by Public.		Bought by Official Inspectors.	Total.	Good.	Passable.	Bad.		Total.
	Qualitative.	Quantitative.					Not Injurious.	Injurious.	
Wine	366	22	125	513	78	149	152	58	437
Vinegar	4	5		8	2	3	3		8
Beer	12		6	18	7	2	11	1	21
Cider	4		13	17	10	1	6		17
Spirits of Wine			1	1		1			1
Syrups	1		4	5	1		3	1	5
Water	13	4	1	18	9	1		11	21
Milk	11		149	160	69	68	93		230
Butter	4		7	11	14	2			16
Oil	1	1	2	4	1		2		3
Flour	3	1		4	1	2	1		4
Bread	3	1	1	5			1		1
Sugar		1		1				3	3
Preserved Food	4			4	2		2		4
Preserves	1			1		1			1
Salt	4	2	68	74	37		23		60
Coffee	3			3	1	1	1		3
Chocolate	3		1	4	2		1		3
Confections	1			1	1				1
Colouring Matter and Coloured Toys	32	2	14	48	6			24	30
Paper					1			1	2
Pharmaceutical Preparations	9			9				2	2
Perfumery		2		2	7				7
Sundries	13		91	104	11		28	68	107
Total	492	41	483	1015	260	231	327	169	987

THE CUSTOM HOUSE AND ADULTERATION.

Under the Sale of Food Act a laboratory was established at the Custom House for the purpose of testing the quality of tea imported of a doubtful character, and the department appears, after ten years' experience, to be exhibiting considerable activity. It is satisfactory that the number of samples of tea condemned form, after all, but a small proportion of those tested. Out of 1,242 samples sent into the Commisioners' analyst in the course of last year, 16 lots only were declared unfit for human food. The goods which were in consequence absolutely refused admittance into this country were varieties of tea, or pretended tea, numbering in all 1,153 packages, of which 500 consisted of "faced" green teas, and 500 of leaves other than tea cunningly made up to imitate a green tea well known in our markets under the name of "Imperial." The remainder were decaying congous and "fannings."

THE POISONING BY HOT-CROSS BUNS AT INVERNESS.

The report of the analyst employed by the Crown in the above case has been sent to the Crown office. No arsenic was found in the buns nor in any of the ingredients from which they were made, nor any trace of metallic poison. There was found, however, an alkaloid possessing irritating qualities, but its exact nature has not been determined. It appears from the evidence collected by the authorities, that loaves and buns were both made from one lot of dough, spice being added for the latter. The loaves turned out perfectly good, the buns bad. The natural inference is that the poison, whatever nature, was in the spice.

REPORTS ON ADULTERATION IN THE STATE OF NEW YORK,

From the *Sanitary Engineer*, New York.

(*Continued from page* 125.)

VEGETABLE FOOD.

GROUP IV.

CEREALS, and the products and accessories of Flour, and Bread Foods; Wheat; Rye; Barley and Rice; Oat-meal; Corn-meal; Sago; Tapioca and Leguminous preparations; Special Artificial Foods for Infants and Invalids; Baking Powders; Cream Tartars; Bicarbonate of Soda; Bicarbonate of Ammonia; Alum Powders and the "Alum Question."

Report by E. G. Love, Ph.D., of New York.

As the specified object of these examinations was to obtain information relative to the extent and nature of the adulteration of foods and drugs sold in the State, attention was principally directed to those articles most liable to adulteration. For this reason, and because the time for the investigation was necessarily limited, the subject of "Infant Foods" is not considered in the report. Previous examinations had shown that these articles of food were not adulterated; and the nature of any investigation in this direction would concern their dietetic value alone. While the subject of infant foods is of great importance, it was considered better to leave it for separate study, rather than to commence an examination, which under the circumstances, must have been more or less superficial.

As to methods of examination, the microscope was mainly depended upon for the detection of foreign matter of a purely vegetable nature, while for the inorganic adulterants the simple methods of the laboratory were employed. The detection of the different starches is readily effected by the microscope, in which polarized light is employed with advantage. A little practice in the examination of starches of known origin enables one to distinguish them without much difficulty.

Dr. Love has considered the "Alum Question," at some length, "inasmuch as the very general use of alum baking powders in this country made it desirable to ascertain the prevalent opinion of chemists and physiologists, regarding the wholesomeness of such preparations."

BAKERS' CHEMICALS.

The most important of these are saleratus, baking soda, cream of tartar, and baking powders.

Saleratus.—This term was originally applied to bicarbonate of potash, which was used in connection with cream of tartar to obtain carbonic acid gas for leavening purposes.

The greater cost of this salt has led, however, to the substitution of the cheaper compound, bicarbonate of soda; and at present none of the potash salt is sold by grocers. "This substitution cannot be considered as an adulteration, inasmuch as there is nothing necessarily restricting the name 'saleratus' to the bicarbonate of potash, and so long as the commercial article is sold at the price of the soda compound, there is no evidence of intention to defraud."

Twenty samples of saleratus were examined, and, in every case, the salt was the bicarbonate of soda. No adulteration was detected. The samples were put up in paper packages, and in most cases bore the manufacturer's name. The practice of selling such articles in bulk is objectionable as offering greater facilities for adulteration.

Baking Soda.—This is the commercial bicarbonate of soda, which as such is employed in cooking, and also forms one of the active ingredients of baking powder. Of twenty-three samples examined, only three were adulterated; one with ground gypsum, to the extent of 25 per cent.; another with gypsum and starch; and the third with sulphate of soda, and about 17 per cent. of carbonate of lime.

The low cost of baking soda offers little temptation to adulterate it. Small quantities of the sulphate and chloride of sodium are always present in the commercial article as natural impurities in its manufacture, but they are in no way injurious, and, if removed, would very greatly increase its cost. From determinations made in the case of eight of the samples submitted, it appears that the amount of sulphate of soda present varied from 0·88 to 2·22 per cent. of the anhydrous salt.

Cream of Tartar.—The comparatively high price of this salt maks it an article of frequent adulteration. Of twenty-seven samples examined, 16 were adulterated, and, in some cases, not a particle of cream of tartar could be found. The adulterants used were terra alba, starch, phosphate of calcium, and tartaric acid. Six samples were adulterated with terra alba alone, seven with terra alba and starch, one with starch alone, and two with starch, terra alba, and acid phosphate of calcium. In six samples tartaric acid had been substituted for cream of tartar, and in each case the sample was otherwise adulterated. In eight samples the amount of terra alba was determined, and found to range from 3·27 to 93 per cent. Five samples contained over 70 per cent. of this adulterant. Commercial cream of tartar contains a certain amount of tartrate of lime, as an impurity; and although this salt is not injurious, its presence diminishes the value of the article. No limit has been fixed to the amount of tartrate of lime allowable in cream of tartar, and yet there is no reason for not fixing some limit. In twelve of the samples examined the amount of tartrate of lime was determined, and found to vary from 3·54 to 10·59 per cent., the average being 8·2 per cent. Some of the samples were purchased of druggists, and the results show that the amount of lime tartrate in these was fully as large as in the samples bought of grocers.

Baking Powders.—These are artificial preparations employed as substitutes for yeast. They consist of bicarbonate of soda, and some acid or acid salt, which on the addition of water, react upon each other with the liberation of carbonic acid gas. There are four kinds of baking powders in use, the difference consisting in the nature of the acid compound used. In the first, cream of tartar is employed; in the second, tartaric acid; in the third, acid phosphate of lime; and in the fourth, potash or ammonia alum. Moreever, many powders contain a salt of ammonia, generally the sesquicarbonate. The pungent odour of this salt prevents its use in any but the the smallest quantities, and as so used it cannot be considered as in any way injurious.

To prevent a natural deterioration in the powder, most manufacturers add flour or starch, which, within certain limits, is not considered as an adulteration, although its excessive use might become such. Eighty-four baking powders were submitted for examination, which may be classified as follows: cream of tartar powders, 49; tartaric acid powders, 3; alum powders, 20; phosphate powders, 3; besides which, eight were mixtures of cream of tartar, and alum, and one of phosphate and alum. Seventy-three powders contained flour or starch, and thirty-five contained ammonia. Eight of the powders were found to be adulterated; six with terra alba, one with insoluble phosphate of lime, and one with tartrate of lime, doubtless as an adulteration of the cream of tartar employed.

FLOUR AND BREAD.

The term flour, in its more restricted sense, is applied to the powder obtained by grinding the various cereals used as food.

Wheat Flour.—Thirty-five samples of wheat products were submitted for examination, including eight samples of "gluten flour," and three of "farina." There are quite a number of "gluten flours" in the market, which are supposed to contain a special addition of gluten. The samples submitted were found to be free from adulteration; and while some can honestly claim to be gluten flours, others are ordinary wheat flours. As to the other samples of wheaten flour, no adulteration was detected. Mention is made of the adulterants which are sometimes added to wheat and other cereal products. The use of alum, so far as it acts injuriously upon the human system, is considered elsewhere in the report, "but its addition to damaged flour should be emphatically condemned, aside from the question of its wholesomeness." In damaged flour the gluten has undergone a partial decomposition, or fermentation, giving a dark appearance to the flour. The alum acts as an antiseptic, checking this

decomposition, and giving a bread much whiter than could otherwise be obtained. In this way the unscrupulous are able to make a bread possessing the appearance of a first-class article, from material unfit for human food.

Of the animal and vegetable parasites of grain, the most important are smut, mildew, darnel, rust and ergot. There seems to be sufficient ground for the statement that some of the ill effects generally attributed to other causes are in reality due to a vegetable parasite.

Flour of Rye, Barley, Corn, &c.—Of these little need be said here. As a rule they were found free from adulteration. The following shows the number of samples examined: of oat-meal, 12 samples; barley, 7; rye, 7; corn-meal, 10; corn-starch, 2; rice, 5; buck-wheat, 8; sago, 5; and tapioca, 7. One sample of rye-flour was adulterated with wheaten flour of an inferior quality.

Arrowroot.—Genuine arrowroot is the starch obtained from the tubers of *maranta arundinacea.* The term, however, is applied to a number of other starches obtained both from tubers and cereals; and there is, consequently, much confusion with regard to the use of this word. It is a common practice to affix the name of the place where the starch was supposed to have been produced; but this gives no information as to the exact nature of the product. The only remedy for this evil consists in requiring all dealers to mark the arrowroot with the name of the plant from which it was obtained; and also, that mixtures of different starches be marked as such. Of twenty-three samples of "arrowroot" examined, seventeen consisted entirely of Maranta starch, and six of substitutions. One was a mixture of Maranta and tapioca starches, two were Maranta, tapioca and potato, and three consisted of tapioca and potato.

Bread.—Ten samples of wheaten bread were submitted and subsequently examined both chemically and microscopically. Special attention was paid to the detection of copper, alum, &c., and in no case were these substances found. The percentage of moisture in the breads varied from 41·5 to 43·9; and the amount of ash varied from 0·915 to 1·134 grams in 100 grams of bread.

Methods of Examination.—The microscope must be relied upon almost exclusively for the detection of the various starches and abnormal vegetable growths. The detection and estimation of mineral adulterations is readily accomplished by ordinary analytical methods. The determination of alumina, however, for the purpose of deciding the presence of alum, requires considerable care, inasmuch as the amount of alumina, even in an alumed flour or bread is very small, and, under some circumstances might be mistaken for that naturally present in the ash of the flour itself. It is customary to make some allowance for the alumina of the ash, but no fixed amount has been agreed upon by analysts. Of the various methods for the determination of the alumina, preference is given to that suggested by Mr. Dupré and modified by Mr. Wanklyn. It depends upon the insolubility of the phosphate of alumina and the solubility of the phosphates of calcium and magnesium in acetic acid.

THE ALUM QUESTION.

"In the making of bread and foods of a similar nature, alum is sometimes added to the flour for one of two reasons—either to disguise the inferior quality of a damaged flour, or as a constituent of baking-powder used as a substitute for yeast." In the former case the use of alum must be considered as a very objectionable form of adulteration, not necessarily in itself, but as permitting the use in articles of food of material having little or no value.

The alum question, as it has been discussed in England and France, has had reference more to the use of alum in flour, in which case there was greater probability of its entering the system in its natural condition. In this country, however, the question of more immediate importance has reference to the use of alum in baking-powders where the alum suffers decomposition before the food is eaten. The objections urged against the use of alum have been based more upon theoretical than upon practical or experimental grounds. Many have argued the question upon the physiological effect of alum as described in works on Materia Medica, concluding that its effects as usually taken in food are necessarily the same. The advocates of alum powders, whilst recognising the effect of alum taken medicinally, claim that in baking the powder undergoes decomposition with the formation of the hydrate or of the phosphate of alumina. Moreover, that the amount of alum is small, and consequently without injurious effect.

Our space will not allow of our following this paper through; but we may state that Dr. Love cites a number of authorities for the purpose of establishing two points, viz.—is the phosphate of alumina formed? and if so, is it soluble in the digestive fluids? The testimony on these points is so conflicting that no positive conclusions can be drawn from it.

Numerous opinions are then quoted as to the injurious effect of alum upon the human system.

The legislation on this subject in England and France does not especially prohibit the use of alum. In the former the Adulteration Act of 1821 did prohibit its use, but later Acts do not mention it; and under the present law, before convictions can be obtained it is necessary to establish the fact that alum is injurious. In France its use is indirectly prohibited; while in Germany the use both of sulphate of copper and alum is forbidden.

It is stated in conclusion, "that at the present time there does not seem sufficient evidence as to the injurious effects of alum upon the human system to warrant legislation against it."

GROUPS V. AND VII.

V.—CANNED FRUITS AND VEGETABLES; Preserves; Vinegar; Pickles; Mustard; Ginger; Spices; Antiseptics employed in preserving; Glazing and Enamel, as affecting Food Articles.

VII.—TEA; COFFEE; COCOA.

Report by Prof. S. A. Lattimore, Ph.D., of Rochester University, Rochester, N.Y.

CANNED FRUITS AND VEGETABLES.

Nine samples of canned fruits were examined, including peaches, plums, grapes, strawberries, cherries, blackberries and olives; and the same number of canned vegetables, including mushrooms, corn, beans, peas, succotash, tomatoes and pumpkin. No indication of adulteration was found in any of these foods. "Attention was given to the possibility of the chemical reaction of the fruit acids upon the inner surface of the cans, whereby salts of tin and lead might be produced, rendering the contents in some degree poisonous."

VINEGAR AND PICKLES.

Four samples of vinegar and nine of pickles were submitted for examination. The vinegars "were all of inferior quality, being deficient in acetic acid, but free from mineral acids, and must be classed as unadulterated unless an excess of water may be considered an adulteration." The samples of pickles "gave no evidence of the presence of copper or other metal. The only sample which possessed a suspiciously green appearance was found to contain alum."

SPICES.

Prof. Lattimore's report furnishes abundant proof in support of the common impression regarding the adulteration of spices. The following table shows the number of samples examined, and the extent of their adulteration:

	Number of samples examined.	Number Adulterated.	Percentage of Adulteration.
Mustard	18	12	66·6
Ginger	15	9	60·0
Allspice	27	19	70·4
Cinnamon	22	18	81·8
Cassia	7	4	57·1
Cloves	21	16	76·2
Pepper—black	40	28	70·0
" white	7	5	71·4
" red	10	5	50·0
Mace	8	4	50·0
Nutmeg	5	2	40·0

"As the above table shows, a large proportion of them are adulterated, and that with substances presenting a certain uniformity. The spices present an inviting field for the exercise of fraudulent arts. They are almost universally sold in the form of fine powder and in opaque packages, which do not admit of easy examination on the part of the purchaser. Consequently, any cheap substance which may be easily pulverised to a similar degree of fineness, and which possesses little distinctive taste or odour of its own, answers the purpose; so that the list of adulterants for this class of articles is naturally very large. The adulterations found in the samples now under consideration may be classed into four groups. First, integuments of grains or seeds, such as bran of wheat and buck-wheat, hulls of mustard seed, flax seed, &c. Second, farinaceous substances of low price, such as are damaged by the accidents of transportation or long storage—such as middlings of various kinds, corn-meal, and stale ship's bread. Third, leguminous seeds, as peas and beans, which contribute largely to the profit of the spice mixer. Fourth, various articles, chosen with reference to their suitableness for bringing up the mixture as nearly as possible to the required standard of colour of the genuine article. Various shades, from light colours to dark browns, may be obtained by the skilful roasting of farinaceous and leguminous substances. A little turmeric goes a great way in imparting the rich yellow hue of real mustard to a pale counterfeit of wheat flour and terra alba, or the defective paleness of artificial black pepper is brought up to the desired tone by the judicious sifting in of a little finely pulverised charcoal. Enough has been already given to show that the field for sophistications of this sort is a wide one, and offers large scope for the development of inventive genius; so that each manufacturer of articles of this class would be likely to possess his own trade secrets. It will be observed that the adulterating materials just mentioned all belong to the class claimed to be harmless. In no instance has any poisonous substance been discovered. The proportion of foreign and genuine substances in the spices varies between wide limits, in some instances the former being slight; in others, the latter seemingly present in just sufficient quantity to impart faintly the requisite taste or odour. Even this small proportion of the professed article is occasionally farther diminished by the substitution of other substances; as for example, in imparting to corn-meal finely ground a pungency suggested by real ginger by the addition of a little salt and red pepper."

COFFEES.

Thirty-five samples of unroasted coffee were examined. "In five packages a few grains were discovered which had been slightly coloured or faced. A minute quantity of blue pigment adhered to the more prominent parts of the bean, giving a somewhat brighter colour to the coffee when viewed *en masse*. It was apparently Prussian blue, the quantity obtained being too minute to permit satisfactory chemical tests. No lead chromate could be recognized." The coloured coffee was inferior in quality, and it was thought that the colouring matter would separate in the process of roasting. The three samples of roasted, unground coffee examined were free from adulteration. Twenty-one samples of ground coffee were examined, and in nineteen of them foreign substances were discovered. These substances were chicory, beans, and occasionally wheat or other grain coarsely ground. One sample consisted entirely of roasted hominy. Three samples of coffee extract were composed chiefly of caramel and liquorice, and contained no coffee.

TEAS.

Forty-three samples of green tea and eighteen of black tea were submitted for examination. "Many of these are of the cheapest and most inferior quality, some of them mere tea-rubbish, yet no leaf or fragment of a leaf which has been examined could be considered anything but tea." No mineral matter was found which could not be "fairly credited to the rude and careless manner in which it is handed by the rough employés of the tea-farm." Neither have any positive evidences been discovered of the admixture of exhausted leaves. If they are present, the admixture is too slight to render detection possible by the determination of the percentage of extract or tannin.

(To be continued).

ANALYSTS' REPORTS.

Mr. James Baynes, junr., has reported to the magistrates for the East Riding of Yorkshire, that during the quarter he had analysed seven samples of milk, two of bread, one of white pepper, one of coffee, one of sweet nitre, one of coarse sugar, and one of black tea, all of which were pure. One sample of sweet nitre was adulterated with 14 per cent. of water, one of coffee with 75 per cent. of chicory, one of milk with 7 per cent. and another with 15 per cent. of water.

Mr. T. Fairley, analyst for the North Riding of Yorkshire, presented the following report at the Sessions:—"I beg to submit the following report on analyses made for the North Riding, under the Sale of Food and Drugs Act, during the quarter ending June 30, 1882:—The samples received have been—Two each of milk, lard, and pepper, and one each of flour, sago, tapioca, baking-powder, whiskey, and vinegar; total, twelve samples. None of these samples were found to be adulterated. It is desirable, when few samples are taken, that they should be such as are consumed most largely, such as bread, butter, tea, coffee, &c., and other articles but little used should be sent where special suspicion has arisen or complaints been made."

In Wilts during the past quarter Mr. Donkin has analysed seven samples of food, beer, and spirits, but only one person was proceeded against, a penalty of £10 being recovered.

In Somerset no less than 146 samples were analysed, and of these one of mustard, one of cocoa, two of milk, and one of gin were adulterated—none, however being prejudicial to health.

At Herefordshire Quarter Sessions, Sir Richard Harrington, the chairman, read a letter from Mr. Horsley, the County Analyst, who said that at the last two or three quarter sessions some rather disparaging remarks having been made reflecting upon him and his appointment, he went to Hereford and saw the new Clerk of the Peace, and promised to send him copies of all the correspondence the committee had with him on the matter, which dated as far back as 1877. The enclosures referred to by Mr. Horsley referred to his appointment, salary and duties. The Chairman remarked that he answered the letter stating that no one had any intention to disparage Mr. Horsley, but that certain members of the Court were of opinion—and he could not say without reason—that the appointment of a gentleman out of the county was an improvident one. The Court endorsed the Chairman's action. Mr. Horsley lives at Cheltenham.

At a special meeting of the Marlborough Town Council, the Town Clerk, as the Council had some time since instructed the police to take proceedings under the Sale of Food Act, reported that it had been pointed out by the chief constable that the borough had not the intrinsic authority to order this work to be done by the police. Those only who had the power to instruct the police were the county authority. The Council, under these circumstances, decided to instruct its own medical officer of health and inspector of nuisances to carry out the duties under the Act.

LAW REPORTS.

Dandelion Coffee—Conviction:—

At the Bakewell Petty Sessions, on Saturday, before Mr. R. W. M. Nesfield and Mr. F. Craven, Mr. Richard Robinson, grocer, Chelmorton, charged with selling coffee adulterated with the root of dandelion to the extent of 15 or 20 per cent., was fined £1 and 10s. costs.

Butter and Beef Fat:—

At the Liverpool City Police Court, recently, Mr. John Jones, grocer, 8, Great George's Place, was summoned for selling butter which was found to be adulterated with 30 per cent. of beef fat, and he was fined 20s. and costs.

At the Leicester County Police Office lately, Mr. Henry Chapman, grocer, of Markfield, was charged with selling adulterated coffee. Deputy Chief Constable Moore said on the 9th May he visited the defendant's shop, and purchased from his wife half a pound of coffee. He told her he had bought the coffee for the purpose of having it analysed and divided it into three portions, one of which he himself kept, another he gave to the defendant's wife, and the third he forwarded to Dr. Emmerson, the County Analyst, for examination. On May 22 he received a certificate from the analyst, stating that the coffee was adulterated to the extent of 33 per cent. with chicory. About an hour and a half after he had made the purchase, defendant's wife came to him, and said she had made a mistake, having given him chicory-and-coffee, instead of coffee. Defendant admitted the offence, and was fined 20s. and costs or ten days' imprisonment.

Lard and Water:—

At the Eddisbury (Cheshire) Police Court, recently, John Bleaze, shopkeeper, of Kingsley, was rdered to pay 16s. costs for having sold to Police Superintendent Naylor half a pound of lard which was ertified to have been adulterated with 18 per cent. of water.

At the Wallasey (Cheshire) Petty Sessions, lately, Mr. Daniel Cunningham, provision lealer, Wallasley Village, was summoned for selling 1lb. of butter which was not of the nature, substance, nd quality required. Inspector Dutton, of the Cheshire Constabulary, went to the defendant's shop nd asked for 1lb. of butter, which he paid for and handed over to Mr. Carter Bell, of Manchester, the County Analyst. Superintendent Egerton produced a certificate from that gentleman, stating that there was only 25 per cent. of genuine butter in the sample, the remaining 75 per cent. being made up of fat, &c., The magistrates imposed a fine of 5s. and £2 13s. costs.

"Special" Butter:—

At the Hull Police Court. on June 21, Mr. F. Hodgson, grocer, Hessle Road, was summoned for elling half a pound of butter which was not of the nature, substance, and quality demanded by the urchaser. Mr. Wilson, Deputy Town Clerk, prosecuted on behalf of the Urban Sanitary Authority of he Hull Corporation. Mr. J. Osborne, the inspector under the Food and Drugs Act, visited defendant's hop on May 13, and asked for half a pound of butter, which was sold to him for 7d. He told lefendant he had purchased it for analysis, and Hodgson said he had bought it for butter, and he was elling it as such. The butter, on being analysed, was found to contain 75 per cent. of foreign fat. Defendant now said he bought the butter as per sample, and paid 108s. per cwt. for it. Mr. Twiss: If you can prove that you bought it as pure butter it will relieve you. Defendant produced an invoice, which, however, simply specified "five casks, special." His Worship said he could not take this into onsideration. The defendant was further summoned for selling a quarter of a pound of adulterated offee. On the same day the inspector asked for pure coffee, and was served with a quarter of pound of n article which upon analysis was found to contain 20 per cent. of chicory. Defendant said that when the inspector asked him for this article he asked the lad which coffee he had ground last, nd the wrong tin was pointed out to him. The sanitary inspector corroborated this statement, and urther stated that he bought both the butter and the coffee before he said they were for analysis. Mr. Twiss fined defendant 60s. and costs for selling adulterated butter. He said it was possible there might ave been some mistake about the coffee, and in that case judgment would be respited on payment of osts.—Mr. John Hunter, grocer, 44 and 46, Great Passage Street, Hull, was also summoned for selling ne pound of butter which on analysis was also found to contain 75 per cent. of foreign fat. There was ittle or no excuse in this case, and the defendant was fined 50s. and costs.

Orleans Butter:—

At the Cardiff Police Court, before Mr. R. O. Jones and Alderman Evans, J. Rees Evans, grocer, of Star Street, was summoned for selling as butter a substance not of the nature asked for. Mr. Thorpe, Deputy Town Clerk, prosecuted. It appeared that Police Constable Crocker went to the defendant's hop and purchased from an assistant three-quarters of a pound of butter. He saw the defendant, and old him that he purchased the butter for the purpose of having it analysed. The defendant replied "All right." Witness left the shop, but the defendant ran after him and told him that it was Orleans butter. He asked the assistant for three-quarters of a pound of butter, and the assistant said they had been selling that butter at fourteenpence a pound, but that it had "gone off a little." Mr. Thomas, the Borough Analyst, said that it was an article got up to resemble butter. It was known as butterine, and contained a quantity of fat, but no appreciable quantity of butter fat. The defendant said he had bought it as Orleans butter. The magistrates fined the defendant 40s. and 18s. costs.

"Real" or "Mixed" Mustard.

Sarah Rowland, provision dealer, of Tattenhall, Cheshire, was summoned before the county justice at Broxton, recently, for selling mustard which the certificate of Mr. Carter Bell, the Public Analyst, showed to have been adulterated to the extent of 5 per cent. with farinaceous matter. Defendant said that she procured the mustard from a firm in Chester, the executors of the late Mr. John Fleet. She ordered "real" mustard, and the article was sent to her as "real" mustard, and not "mixed mustard." She bought it as pure mustard. In ordering defendant to pay the costs, the chairman of the Bench informed her that she might enter an action against the parties from whom the article was procured. The costs amounted to £1 6s. 8½d.

BEER ADULTERATION BILL IN THE HOUSE OF COMMONS.

On Tuesday, July 4th, Mr. Hicks moved the second reading of the Beer Adulteration Bill, upon which the House was counted out, and the Bill became a "dropped order."

Mr. J. C. Thresh, pharmaceutical chemist, Buxton, obtained the degree of Doctor of Science in the University of London at the recent examinations.

RECENT CHEMICAL PATENTS.

The following specifications have been recently published, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

No 1881	Name of Patentee.	Title of Patent.	Price
4948	G. André	Electric Lamps	1s.
5024	E. Carey & H. Gaskell, &c.	Manufacture of Bichromate of Soda	6d.
5198	C. H. Biggs & W. Beaumont	Secondary Batteries	6d.
5216	J. E. Liardet and T. Donnithorne	Hydraulic Motors	8d.
5229	W. R. Lake	Utilization of Electricity for Lighting	4d.
5233	Ditto	Utilization of Electricity for Lighting	1s.
5261	H. E. Newton	Secondary Batteries	6d.
5262	C. D. Abel	Manufacture of Chromate of Soda	4d.
5264	Ditto	Manufacture of Chromate of Soda and Chromic Acid	3d.
5278	J. B. Spence & J. Desvignes	Purification of Coal Gas	2d.
5291	W. Spence	Preparing Chrome Yellow and Chrome Red	4d.
5296	F. Worth	Manufacture of Sulpho Acids	4d.
5312	H. W. Deacon and H. Gaskell	Purification of Alkaline Solutions	4d.
5322	J. Imray	Electric Accumulators	2d.
5348	W. Clark	Distillation of Glycerine, &c.	6d.
5338	D. G. Fitzgerald and C. H. W. Biggs, Junr.	Secondary Batteries	6d.
5390	F. Petri	Purifying or Disinfecting Sewage	6d.
5396	C. F. & F. H. Varley	Electric Lamps	6d.
5406	J. G. Williams	Decomposing Common Salt and other Chlorides	2d.
5481	D. G. Fitzgerald	Secondary Batteries	4d.
5490	W. R. Lake	Electric Lamps	4d.
5499	J. W. Swan	Measuring and Recording Electric Currents	4d.
5521	G. Grant and W. H. Jones	Secondary Batteries	4d.
5523	G. Chapman	Apparatus for Separating Ammonia from Gases	6d.
5544	J. Simpson and E. W. Parnell	Treating Alkaline Lime Mud	6d.

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; Journal of Applied Science; The Provisioner; The Practitioner; New Remedies; Proceedings of the American Chemical Society; Le Practicien; The Inventors' Record; New York Public Health; The Scientific American; Society of Arts Journal; Sanitary Engineer of New York; The Chemists' Journal; Oil and Drug News; Sugar Cane; Country Brewers' Gazette; The Medical Record; Oil and Drug Journal; The Canada Lancet; Gas and Water Engineering; The Grocers' Gazette; Columbia School of Mines Quarterly Magazine; London Water Supply, by Crookes, Odling and Tidy.

THE ANALYST.

SEPTEMBER, 1882.

ON THE MANUFACTURE OF SUGAR FROM MAIZE.

By R. H. Harland, F.C.S., F.I.C.

The development of this industry has of late years taken rapid strides, the manufactured article having come into use mainly, in this country, for brewing purposes. In America this class of sugar is largely in demand, and is used most extensively for mixing with cane sugar and cane syrups, whereby the sweetening power of the former is considerably reduced, but a sugar is produced of a much whiter and pleasanter appearance, which commends itself to the consumer.

By far the larger portion of solid grape sugar imported into this country comes from America, but up to the present time its consumption has been restricted to the brewer, and more recently for confectionery and preserving purposes. The quantities imported during the last few years are as follows:—

1879	317,768 cwts.
1880	405,760 ,,
1881	399,648 ,,

This proves that its use is widely extending, and although the figures do not show such a marked increase as might perhaps have been expected, yet the imports of the present year will probably be far in excess of any previous quantity.

In the Colonies this article is already attracting attention, and the time is, probably, not far distant when the districts suitable for the cultivation of maize and other starchy plants will be turned to account for the production of glucose and spirit.

In England there are several manufactories turning out a considerable quantity of liquid glucose (and I may here mention that the term glucose, or grape sugar, is applied to both the liquid and solid article, although, as will presently be shown, they differ materially in composition), but up to the present English manufacturers have been unable to produce an article equal to American, and this is, no doubt, due to the greater demand for the substance in America, which has caused a greater amount of attention to be directed to this industry.

In the manufacture of grape sugar a grain is selected which is rich in starch, and, for this reason, it is the starch which is converted into sugar, so that the larger the percentage of starch the greater is the yield of sugar, providing always that nothing is present in the grain which will cause loss of sugar or deterioration of the product during the operations incidental to its manufacture.

Starch is one of the most widely disseminated substances in the vegetable world. It is contained in the root, bulbs, leaves, bark, blossoms, fruit, and seeds of the most varied species of plants in various proportions, in some cases amounting to within ten to twenty per cent. of the entire weight of the plant. Of course, the quantity of starch varies with the species of plant, the country in which it is grown, and also the mode of treatment during cultivation. The following table will give an idea of the proportion contained in various species of corn and grain:—

	Starch.	Moisture.	Oil.	Albuminoids.	Gum Sugar, &c.	Cellulose.	Ash.	Nitrogen.
Wheat	63·30	14·50	1·90	14·40	—	4·20	1·70	—
Saigon Rice	77·07	12·54	·64	7·86	1·00	·28	·61	(1·17)
European Maize	76·48	12·35	1·58	8·05	—	1·08	·16	(1·28)
White American Maize	71·41	11·88	4·19	7·00	—	4·16	1·36	(1·12)
Red American Maize	74·91	12·05	2·09	5·69	—	4·00	1·26	(·91)
Potatoes	20·0	76·0	—	—	—	—	—	—

Starch belongs to that class of neutral bodies which are termed carbohydrates; its composition is expressed by the formula $C_6H_{10}O_5$ in common with dextrine, cellulose, and other allied bodies which, on being submitted to ultimate analysis, are shown to contain exactly the same number of equivalents of carbon, hydrogen and oxygen, so that the formula $C_6H_{10}O_5$ represents the composition of the class of carbohydrates which includes substances differing materially in appearance and physical properties. Starch is insoluble in cold water, but on being heated with water to a temperature of 60° C. it gelatinizes, and if sufficiently strong is transformed into a jelly or stiff paste; the same result takes place at higher temperatures, the starch granules bursting and dissolving in water.

On heating starch to a temperature of 200° C., it is gradually transformed into soluble starch and dextrine.

On boiling with dilute acids—hydrochloric or sulphuric—dextrine and maltose are formed, which by prolonged boiling are converted into dextrose. It is on this reaction that the manufacture of dextrose, or starch sugar is founded. Represented by chemical equation the action is—

$$\underset{\text{Starch.}}{3C_6H_{10}O_5} + \underset{\text{Water.}}{OH_2} = \underset{\text{Maltose.}}{C_{12}H_{22}O_{11}} + \underset{\text{Dextrine.}}{C_6H_{10}O_5}.$$

After the lapse of some time and continued heating, the dextrine is entirely converted into dextrose.

The part which the acid plays in this reaction is not thoroughly understood, it causes the starch, however, to combine with the necessary quantity of water for its conversion into sugar, remaining unacted upon itself.

Maltose, an isomer of cane sugar, is probably identical with the sugar produced by the action of malt extract on soluble starch, and is always present in properly prepared brewers' worts.

Starch may also be converted into sugar by the action of diastase, a peculiar substance contained in malt. This operation is carried on by the brewer in the preparation

of malt worts, and the action of the diastase on the starch of the grain is, according to the researches of Payen and others, to first convert two-thirds into maltose, and the remaining one-third into dextrose, the maltose undergoing gradual transformation into dextrose, as the dextrose is converted into alcohol and carbonic acid by the action of the ferment.

Conversion of Starch into Sugar.—It is well known that by the action of acids on starch, substances are formed varying in character and composition with the time during which the action of the acid is allowed to take place in a boiling solution. In the preparation of glucose on a manufacturing scale, it is not unusual to employ pressure and an excess of acid over and above the quantity necessary for converting the starch, in order to accelerate the formation of dextrose; numerous patents have been taken out for machinery in order to either more rapidly effect the conversion or to subject the grain after mixing with water to a considerable temperature and pressure in closed vessels, previous to the treatment with acid; but in all cases the whole grain is treated, and the matters left undissolved by the acid are removed by filtration at a subsequent stage.

The quality of the article produced depends in great measure upon the quantity of acid used and the time allowed for the operation. To produce a white starch sugar it is necessary to prolong the treatment until all the dextrine has disappeared, and the resulting solution of sugar is refined with animal charcoal previous to concentration. When a liquid glucose is required, the presence of the dextrine is necessary to preserve the substances in a liquid form, as otherwise partial solidification would result from the dextrose crystallizing out.

In America where large quantities of grain are continually being converted into sugar, the best results both as to quality and price are obtained by first subjecting the grain—generally maize—to a process for the removal of the greater part of the oil and albuminoid materials. This is readily effected by first steeping in cold water for some hours, cracking it either in a disintegrator or between mill stones, and delivering the broken-up maize with water into a centrifugal machine provided with a number of steel beaters revolving in a reverse direction to the machine. This effectually removes the greater part of the starch which is carried away suspended in the water and afterwards allowed to settle out on suitable starch tables. The germ, containing a large proportion of oil and albuminoids, together with the greater proportion of the outer skin or rind is retained in the machine, while the portion which finds its way through with the starch can be readily removed during the process of settlement or by sieves. The starch thus produced is stirred with water to a milk and run slowly into a vat containing boiling dilute sulphuric acid varying in strength from 1 to 5 per cent. The boiling is continued until the whole of the starch is converted into sugar: the time of course varies greatly with the strength of the acid and the quality of the sugar required to be made, but with open converters it is necessary to boil for from four to eight hours, using 2 per cent. acid. It is essential to keep the concentration of the liquid as great as possible so long as the formation of sugar is not impeded, in order to avoid the cost of evaporation. The liquid is carefully neutralized and the resulting precipitated calcium sulphate removed by filtering under pressure from a monte-jus or pump, through a filter press. When solid sugar or dextrose is being manufactured the liquid will have a

density of from 22° to 27° B. and contain from 4·5 to 5·5 lbs. dextrose per gallon, it requires refining by means of animal charcoal exactly in a similar way to cane sugar, and afterwards concentrating in a vacuum pan.

In the treatment of the whole grain a similar plan is adopted, preference being given to shortening the time of conversion by increasing the pressure on the surface of the boiling liquor to 90 lbs. or thereabouts on the square inch, the liquor being neutralized with chalk and the calcium sulphate together with the undecomposed portions of the grain removed by filtration. There are decided objections to be urged against this method which do not apply with equal force when the American mode of manufacture by first removing the impurities is employed.

The valuable nitrogenous portions of the grain are so admixed with calcium sulphate as to render what would otherwise be a valuable feeding material for cattle almost worthless, whereas—as is shown by the following analysis—the American residue contains all the feeding qualities of the grain in a fairly concentrated form.

	Residue when whole Grain is treated.	Residue when Starch is treated.
Moisture	9·00	10·86
Oil	10·00	6·09
*Albuminoids	20·30	13·69
Uncrystallizable Sugar	7·10	—
Starch Mucilage, &c.	—	54·54
Mucilage, &c.	18·50	—
Cellulose	6·80	14·04
Ash	28·30	·78
	100·00	100·00
*Containing Nitrogen	3·25°/ₒ	2·19°/ₒ

Further, it is well known that various organic combinations are formed by the action of the acid on the oily and non-starchy portions of the grain, which not unfrequently impart to the sugar an unpleasant taste and smell, requiring an increased quantity of animal charcoal to remove and absorb them—in fact, it is doubtful whether they are ever entirely removed, but probably small traces remain to the detriment of the finished article, and may be the cause of unsuccessful fermentations when used for brewing, and if required for the manufacture and distillation of alcohol would produce a spirit inferior in flavour to that obtained from sugar prepared from nearly pure starch. It is therefore questionable whether the superior quality of the sugar and the higher value of the residue as cattle food does not more than compensate for the increased cost—about 13s. per ton on the raw grain—in removing the albuminoid substances, and the loss of starch in the food which would otherwise have probably been converted into sugar.

THE SOMERSET HOUSE LABORATORY.

We take the following from the "Report of the Principal of the Laboratory" comprised in the twenty-fifth Report of the Commissioners of Her Majesty's Inland Revenue:—

"The work of the Laboratory has very largely increased during the past year (to 31st March, 1882). The number of samples examined amounts to 26,201, which is an increase of 8,187 on the preceding year.

The increase in the number of samples is principally due to the beer duty, and to the new regulations for determining the obscuration of foreign spirits on importation. The strain on the department was very great; but by great industry on the part of the staff the work has been satisfactorily performed.

Thirty-seven examiners have received instruction in the department during the year.

Eight students have attended the usual course of practical chemistry in this laboratory, and the two courses of lectures on inorganic and organic chemistry at South Kensington.

On the examination of these students by Dr. Frankland, seven obtained first-class certificates, and one a second-class. Three succeeded in securing very high positions in the list, and one of the three obtained 99 out of the maximum number of 100 marks.

REFERENCES UNDER THE "SALE OF FOOD AND DRUGS" ACT.

Forty-one samples were referred to us for analysis by the magistrates under the 22nd section of the "Sale of Food and Drugs Act." These samples consisted of milk, butter, coffee, bread, oatmeal, beer, mustard, and whiskey, and in fifteen instances we were unable to support the certificates of the public analysts.

Certain samples of milk were received from Dundee, the cases being remarkable from the fact that the prosecution did not charge the defendants either with adding water or abstracting cream, but based their claim for a conviction on the ground that the milk was of inferior quality. The "total solids" amounted in each case to between 11 and 12 per cent., and although the proportion of fat was low in each of these samples, yet it was not lower than is found in genuine milk of poor quality, and we reported accordingly.

The cases being novel, the Procurator-Fiscal asked my opinion as to the liability of persons selling milk of low quality, and in my reply I pointed out that the Act of 1875 was silent on the question of standards, or uniformity of quality, and that as I understood, the Act was intended to ensure the supply of such an article as milk in a genuine state, and that no penalty was incurred for a sale of milk in the state in which it was yielded by a cow in a healthy condition, under the usual changes of food and season.

We received from the sanitary authority at Chester a sample of milk for analysis of a somewhat remarkable character on account of the exceptionally low amount of "solids not fat" which it contained. The cow was reported to be healthy and well fed, and she was milked in the presence of the analyst. The ash or mineral matter was abnormally high, and contained an excessive quantity of chlorides, and there was an absence of the usual relation existing between the constituents of a normal milk. We reported that the sample was so abnormal that the results of the analysis would at once suggest an enquiry before recommending proceedings, and that the fact of such a milk having been met with, should exercise little or no influence in dealing with samples of milk obviously reduced in quality by the addition of water.

The samples of coffee referred were all alleged to be adulterated with chicory. In two cases we confirmed the certificates of the analysts, but in two instances the samples were absolutely free from chicory. In one of these cases, the coffee was stated to contain 10 per cent., and in the other 27 per cent. of chicory.

A case in which a sample of bread, alleged to be adulterated with alum, was referred to us for analysis, obtained some notoriety owing to an impression having been produced

at the adjourned hearing on the mind of the magistrate that we might have employed an old process of analysis for the detection of the alum and have failed to discover it. Considering our entirely unbiassed position, and the extreme care which we exercise both in the analysis, and the selection of the analytical processes we employ, it is a matter of regret that, in the interests of justice, our certificate should be made the subject of unfair criticism in our absence. In the case in question there was no ground whatever for such an allegation, the analytical process we employed being thoroughly reliable.

One sample of beer only was included in the reference samples. The allegation was an adulteration with salt, but the result of the analysis showed that the beer contained 11·9 grains only of common salt per gallon. The analyst had ascertained the amount of chlorine and calculated its equivalent in common salt, but failed to determine the actual quantity of chloride of sodium present. A prosecution under the "Sale of Food and Drugs Act" is essentially a criminal proceeding, and the specific charge requires to be fully sustained by the result of the analysis. It is clearly not sufficient on a charge of adding salt to affirm that the chlorine was equivalent to a certain number of grains of chloride of sodium per gallon, without establishing that the equivalent proportion of sodium is actually present."

ADULTERATED BUTTER AND MILK.

In the House of Commons, on Thursday, August 3rd, Viscount Folkestone asked the President of the Board of Trade, when the Statistical Inquiry Committee that was examining into the subject of the better classification of butter, oleomargarine, and other butter substitutes, was likely to issue its report; and whether he would communicate the result of that inquiry to the House.

Mr. Chamberlain said he was informed that the Committee was now considering its report, which would probably be ready in a few days. It dealt with a great many matters besides those referred to in the question. The Committee had been appointed by the Treasury, which would have to decide whether the report was of sufficient public interest to have it presented to the House.

Lord E. Cecil asked the President of the Local Government Board whether his attention had been drawn to the report of Mr. Blyth, analyst under the Adulteration of Food Act, to the Devonshire Court of Quarter Sessions, dated June 13, 1882, in which, speaking of the adulteration of butter and milk, he compared the difference of limit between the Public Analysts of 1874 and that of the Somerset House certificate at the present time; and whether he proposed to take steps in the interest of the public to raise the standard of purity in both those articles.

Mr. Dodson: Mr. Blyth, in his report, speaking of the adulteration of butter and milk, compared the difference of limit between the Public Analysts of 1874 and that of the Somerset House certificate at the present time. There is no doubt as to the difference in limit between the two bodies. The Somerset House analysts, however, are not alone in their opinion, and I am now in communication with them on the subject, but at present I am not prepared to say whether it would be practicable to define any such standard of purity as would effectually protect the public from adulteration on the one hand, and the honest dealer from prosecution on the other, simply because the natural products in which the latter deals may happen to fall below some arbitrary standard of quality.

In reference to this subject the following letter has appeared in *The Times*:—

To the Editor of *The Times*.

Sir,—The answer of Mr. Dodson to the question of Lord E. Cecil, reported under the above heading in the Parliamentary Intelligence in *The Times* of this day, omits some very important facts.

It is quite correct that the chemists at Somerset House have not accepted the limit of purity of milk adopted by the Society of Public Analysts in 1874, although this limit was fixed after the examination of thousands of samples. But Mr. Dodson omitted to state that this "limit" is still in use by the Society, and that, despite repeated discussions as to figures adopted by the Somerset House chemists, no

proposal has ever been brought forward to alter it. Further, the New York State Board of Health have just completed an independent investigation into the matter, and, as the result, have accepted and confirmed the standard of the Society, which now becomes the law of the State. It is understood that several other States have done the same. The Municipal Laboratory at Paris is working on the same basis.

Some of the largest dairy companies in London insist upon their supply being above the Society's limit, and fine the farmers who supply them if it is not. In short, the Public Analysts' limit is all but universally accepted, because it is the carefully considered result of the largest experience, and simply demands that the public should have milk of (at least) low average quality, as proved not only in England, but in America and the Continent.

On the other hand, the chemists at Somerset House, who hardly find an outside supporter, are working on figures which allow the milk of underfed and diseased cows to be sold as genuine. Large milk dealers will not buy on these figures. Why should they be allowed to sell on them?

The public are most concerned in the matter. If they are content with the poor milk so well, let them claim a return to the old price. The dealers will dilute it scientifically, and under chemical guidance, exactly to the proper extent. Milk adulteration is now a science and a success. The reason is not far to seek.

Your obedient servant,

G. W. WIGNER, F.C.S., F.I.C.,

37, Lombard St., E.C., Aug. 4. Hon. Secretary of the Society of Public Analysts.

EXAMINATION OF WINE WITH CATGUT.

The determination of the astringent matters contained in wine is considered a most delicate operation. These matters are various; the principal is a tannic compound called *œnotannin*, and there are several colouring matters closely related to it. The ordinary methods of determination are rather uncertain, especially where there is little astringent matter. M. Girard has lately devised a method of a very simple nature, which has proved to be superior in precision to the others. It depends on the tendency of the matters in question to combine with animal tissues. Long ago Pelouze used skin to separate tannin from gallic acid; others have analysed bark by a process based on absorption of tannin by skin. Some chemists seem to have even tried ordinary skin in the analysis of wines, but it is not well suited for this. M. Girard finds in catgut a pure animal tissue, of definite chemical species, a much better means of determination. He takes some of the fine white violin cords prepared by M. Thibouville-Lamy, the last process of polishing with oil having been omitted. Four or five of these are put together. A certain quantity is soaked in water for four or five hours (one grain having previously been detached to ascertain the water in it); then these swollen portions are put in a known quantity of the wine to be analysed. This is quickly altered in consequence in 24 hours generally, or 48 at most, all colour has disappeared. The tanned and dyed portions of cord are then dried, first in a flat dish, then in a closed vessel at higher temperature. A comparison then made of the original cord (free from water) with the same cord tanned, coloured, and dried, affords a correct estimate of the *œnotannin* and colouring matters of the wine.—*Times*.

COFFEE MIXTURES.

THE Regulations issued by the Inland Revenue Commissioners as to the new stamp duty on coffee mixtures, which we print in this number, are, as will be seen, rather vague, if not contradictory, in character: for whereas by clause (*e*) every packet containing coffee mixed "with any article or substance" is to have an excise label setting forth what the mixture is composed of, yet the last sentence in the regulations states that no excise label will be necessary on a mixture of chicory and coffee, but only a label as already required by the Adulteration of Food Acts for this or other mixtures of coffee and adulterants.

GATESHEAD WATER SUPPLY.

Much dissatisfaction has recently been expressed with regard to the quality of the water supplied to the borough of Gateshead by the Water Company. It had a "fishy" taste and unsavoury smell, giving the impression that a large quantity of fish had been washed in it, or that a considerable amount of cod-liver oil had been mixed with it. Latterly the water has become so unpalatable that many of the inhabitants have discarded its use for domestic purposes, and had recourse again to the springs to be found in the neighbourhood, to supply their daily wants.—*Sanitary Record*.

THE COFFEE QUESTION IN PARLIAMENT.

The consideration of the Customs and Inland Revenue Bill was resumed in Committee in the House of Commons on Monday, July 31st.

On the question that Clause 2 stand part of the Bill,

Mr. Macfarlane complained that while the Indian Government had abandoned the import duty on Manchester manufactured goods, which brought in a revenue of £1,500,000 a year, the Home Government had not removed the duty on Indian tea. He need scarcely ask what, in such circumstances, would have been the course of the Indian Government if it had been independent and not under the control of the Secretary of State. The extent of the injustice inflicted on India would be perceived when it was remembered that in 1860 only about 1,000,000 lbs. of Indian tea was imported into this country, while last year the amount was 46,000,000 lbs. He contended that, subject to the necessities of the revenue, English ports ought to be no less free than Indian.

Sir G. Campbell pointed out the difficulties in the way of the change desired by the hon. member.

Mr. Gladstone said that there was no connection between the free import of manufactured cotton into India and of Indian tea into this country. He agreed with the hon. member, however, as to the importance of the Indian tea trade, which had certainly developed in a surprising manner. So far as regarded the abolition of the Customs duties of India which had taken place while the present Administration was in office, that abolition was not owing to any pressure whatever from the Government at home. It had been done by the free and spontaneous action of the Indian Government itself. Although at other times there had been pressure upon the Lancashire cotton districts, yet he believed that great advantages were combined in the action the Indian Government had taken simply by the abolition of the duties. When the Indian revenues admitted of the abolition, the measure was quite a proper one, altogether independent of the abolition of duties upon articles imported into this country from India.

The clause was agreed to. Clauses 3 and 4 were also agreed to.

On Clause 5, Mr. Magniac moved, in page 2, line 14, to leave out the words "called by any name of coffee, or chicory, or."

Mr. Cavendish Bentinck said that the Committee ought to have explanations from the Government as to the extraordinary position into which this question had got. From the words of the right hon. gentleman on a former occasion it appeared that he proposed to do one thing and the Bill proposed to do another. He asked this question, not as being connected with the coffee trade, but because he was strongly opposed to adulteration in every shape and form. He recollected some years ago hearing the late Chancellor of the Duchy, when President of the Board of Trade, make a very strong speech in favour of adulteration, and he believed that was the only thing the right hon. gentleman did while he was at the Board of Trade. And it was under the right hon. gentleman who was now President of the Board of Trade that we had the extraordinary change in the policy of Her Majesty's Government now proposed. As one of the public he was most desirous of obtaining pure coffee for the poorer classes instead of the abominable mixtures now sold in coffee-palaces. He had been astonished and horrified at what he had seen sold in those places.

Mr. Courtney explained that really no change whatever had been made, as would be seen by referring to the Budget speech of his right hon. friend. As it had been found that some untaxed beverage resembling coffee was sold as coffee, they proposed to prevent that by taxing the untaxed substitute.

Mr. Magniac said he believed the amendment would meet the case.

Mr. Warton remarked that it appeared to be all a question of money with the Financial Secretary of the Treasury, who had not said anything about the health of the people.

The amendment was agreed to.

In reply to Mr. Dillwyn,

Mr. Courtney promised to consider whether it might not be right to allow the sale of quarter-pound packets of the mixtures in question, instead of half-pound packets. If consumers really desired that they should so be sold, the Government would be ready to fall in with their wishes. He explained that the clause did not apply to coffee and chicory, which would still be sold under the same conditions as at present.

The clause was then agreed to.

On Clause 6,

Mr. Magniac moved an amendment providing that on packets purporting to contain coffee with other articles mixed therewith there must be a label giving the names of the articles composing the mixture. The object of his amendment was to insure that everybody buying a packet of coffee mixture should know exactly what he was purchasing. He observed that in the recently presented report of the Agricultural Commission, a recommendation was made that steps should be taken to insure that all agricultural products for consumption by the public should be sold under such descriptions as would indicate their true composition.

After a few words from Mr. Cavendish Bentinck, Mr. Arnold, and Mr. Labouchere, the amendment was agreed to.

Mr. Cavendish Bentinck proposed to add the words "and in the case of coffee the percentage therein contained."

Mr. Dodson said it appeared to him that the amendment of the hon. member for Bedford provided sufficient security for the public without the proposed addition. He did not think it was fair to require a statement of the percentage of coffee. The addition proposed would simply lead to a good many prosecutions.

Mr. Magniac said his amendment was fully considered by the Government, and they were of opinion that it contained all that was necessary for the protection of the public.

Mr. Warton said hon. members cared nothing for any bargain between the Government and the hon. member for Bedford; they cared for the public. Unless the words proposed by the hon. member for Whitehaven were added there might be offered to the public for coffee something containing not 1 per cent. of coffee. The public bought by weight, and therefore he proposed to add the words "in weight" to the amendment.

Mr. Alderman Lawrence thought it was a consumers' question, and that the Government ought to protect the consumers. No substance ought to be sold as coffee unless it contained 50 per cent., or at least 30 per cent. of coffee.

Mr. Courtney said that the hon. member for Bridport, who had found so much fault with the Government for grandmotherly legislation, had been advocating great-grandmotherly legislation in supporting the amendment. Were the people of this country to be treated as so absolutely deficient in the powers of self-management as not to know or be able to test what they were buying? He was surprised that gentlemen on the Liberal benches who had accepted Mr. Cobden's doctrines should be found supporting the amendment.

Mr. Colman thought the amendment would create difficulty in practice, because of the different qualities of the raw material.

Mr. Alderman Cotton supported the amendment.

Mr. Labouchere objected to hon. members proposing amendments, and then agreeing with the Government to emasculate them. He was as thorough a free-trader as any man; but if Mr. Cobden's principles were against the amendment, he differed from Mr. Cobden. It was a question of protecting the poor against the grocer. The grocer only gained 1d. or 2d. a pound on genuine coffee; whereas on the spurious article, in which there might be a fractional part of the best article, and a large proportion of fig-dust or beans, or chicory, he gained 5d. or 6d. a pound. If the Secretary to the Treasury objected to the amendment, he wondered why he insisted on the statement that the article sold was not really coffee, but a mixture of coffee and this or that substance. If the adulterating substance were stated, why not also the amount of such substance? He hoped the right hon. gentleman would stick to his amendment.

Mr. Macfarlane thought the poor ought to be protected. Under the Adulteration Act they had no protection, because as a first step they had to pay the prohibitory charge of 10s. to the Public Analyst.

Mr. Dodson wished to point out that the Government proposal, instead of tending to facilitate adulteration, as some hon. members seemed to think, was really an extension with respect to that one article of the Adulteration Act.

Mr. Baring hoped that as the Government had made up their minds to take a step in the right direction, they would not object to go a little further.

Mr. Buxton remarked that out of twenty-one samples of so-called coffee obtained at random in London, one was found to be pure coffee, eighteen were more or less adulterated, and two contained no coffee at all. In these circumstances, it could not be a matter of surprise that the consumption of coffee had very much diminished.

Sir G. Campbell thought that the protection given to purchasers should not be a sham, and that the percentage of coffee should be stated.

Mr. Onslow considered that it was incumbent on the Legislature to see that the public were not cheated in this matter.

Mr. Slagg objected to the amendment because it would set up an entirely new principle with regard to trade.

Mr. Cavendish Bentinck was of opinion that the House ought to do its best, by grandmotherly legislation or otherwise, to protect the poor people who were consumers of coffee. At present they had no guarantee that they would get coffee at all, for there was not that distinction between coffee and chicory which ought to exist. He had been an anti-chicorist all his life. These mixtures might contain no coffee at all, and malt-chicory might be a more correct designation than malt-coffee. For these reasons he thought there ought to be a specification, and he could not see why there need be any difficulty about giving the estimated percentage upon the labels. If admixtures were sold it ought to be at the peril of the seller, and the buyer ought to be protected.

Mr. Alderman Lawrence said it was a new principle to levy a tax upon an adulterated article. If coffee were the first thing named that very fact would give the impression that it was the principal ingredient in the mixture. The rich could protect themselves, but the poor could not. The progress of temperance was involved, for if a man were induced to try a cup of coffee instead of a glass of ale, and in lieu of coffee he had one of these miserable mixtures, he might decline to substitute coffee for intoxicating drinks.

Mr. Whitley thought there would be difficulty in giving the exact proportions of these compounds.

The amendment of Mr. Warton was withdrawn, and the question then put was the addition of the words "and in the case of coffee the percentage thereof therein contained."

The committee divided, and the numbers were:—

For the amendment	73
Against	114
Majority	—41

The clause was then agreed to, as were also Clauses 7 and 8.

Clauses 9 and 10 were omitted.

In the House of Commons, on Wednesday, (Aug. 2nd) on the report of amendments in the Customs and Inland Revenue Bill being considered,

Mr. Courtney moved an amendment in regard to coffee mixtures, enabling those articles to be sold in quarter-pound packages, duly labelled, instead of a minimum of half-pound packages, the smaller quantity being required to meet the convenience of the humbler classes.

The amendment was agreed to.

The Bill was then ordered to be read a third time on Thursday (3rd), when it was accordingly passed.

CHICORY.

Year ending 31st March.	Quantity charged with Duty.
1881	2,365 cwts.
1882	2,869 „
Increase	504 „

The growth of this article in the United Kingdom has been gradually diminishing since 1871, and the slight increase shown in the last year is rather due to casual circumstances than any revival in the cultivation of this root. The quantity in bond at the end of the year was about three-fourths of the year's produce. The acreage planted is now probably less than 100 acres.—*Inland Revenue Commissioners' Report.*

Mr. Stoddart, of Bristol, has been unanimously re-elected analyst for Salisbury at an annual salary of £25. The samples submitted for analysis last year from Salisbury were numerous, and there was little, if any, adulteration.

SOCIETY OF PUBLIC ANALYSTS.

Analyses of English Public Water Supplies in August, 1882. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Date when drawn.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine in Chlorides.	Phosphoric Acid in Phosphates.	Nitrogen in Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in		Hardness, Clark's Scale, in degrees.		Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
									15 mins. at 80° Fahr.	4 hours at 80° Fahr.	Before Boiling.	After Boiling.			
Liverpool	Aug. 23	yell. green	v. slight	1·15	traces	·04	·0014	·0011	.014	·050	4·5°	4·0°	8·5		A. Smetham.
Maidstone—															
Wtr. Company	,, 15	p. grnsh. blue	none	2·60	trace	·51		·0014	·023	·032	18·8°	7·1°	32·3	none	M. A. Adams.
Public Conduit	,, 15	p. blue	none	2·80	trace	·54		·0010	·014	·023	18·4°	6·9°	32·8	none	M. A. Adams.
Manchester ..	,, 21	s. turb. f. yell.	none	·73	none	none	·002	·0065	·059	·109	2·0°	1·9°	5·0	satisfactory	W. Thomson.
Margate	,, 18	yell. green	none	26·41	none	·43	·0066	·0094	·020	·036	20·8°	7·4°	80·1	veg. deb.	G. W. Wigner.
Northwich	,, 8	grn. yell. s. turb.	none	2·70	h. traces	·10	·0007	·0016	·019	·031	14·0°	11·0°	21·0	veg. deb., diat., movg. org.	C. M. Blades.
Norwich	,, 10	p. grnsh. yell.	none	2·00	traces	·07	traces	·0054	·053	·070	11·2°	3·9°	16·5		W. G. Crook.
Nottingham ..	,, 15	green blue clear	none	1·26	none	·46	·0014	·0029	·010	·020	10·0°	7·4°	17·2	veg. deb., mycel. fib. anim.	Wigner & Harland.
Portsmouth ..	,, 12	clear	none	1·25	traces	·23	traces	·0032			11·3°	2·1°	18·5	veg. deb., diatoms	W. J. Sykes.
Rugby	,, 19	c. p. yellow	none	1·24	h. trace	·02	·0070	·0210	·028	·100	17·5°	7·5°	28·1	veg. deb., diatoms infus.	A. P. Smith.
Salford	,, 15	c. s. yellow	none	·60	none	trace	·0009	·0010	·001	·015	3·0°	2·5°	4·0	none	J. Carter Bell.
Swansea	,, 22	v. s. turb.	none	·80	s. trace	none	·0003	·0042	·003	·004	1·0°	1·0°	3·3	none	W. Morgan.
Whitehaven ..	,, 4	c. f. green	none	·42	none	·01	none	·0007	·007	·021	·4°	·4°	2·1	veg. deb., diatoms	A. Kitchin.
Worcester	,, 9	p. yellow	slight	3·75	trace	·17	·0010	·0072	·105	·145	13·9°	6·6°	20·3	veg. deb.	W. E. Porter.

Abbreviations:—c., clear; f., faint; h., heavy; p., pale; v. h., very heavy; v. s., very slight.

ERRATA.—In the August Table, Exeter Water unfiltered, the figures for Oxygen absorbed in 4 hours should be ·114 instead of ·011.

* As the Chelsea Analysis has not reached us up to the time of going to press, it will be inserted in the October number.

SOCIETY OF PUBLIC ANALYSTS.

Analyses of English Public Water Supplies in August, 1882. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Date when drawn.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine in Chlorides.	Phosphoric Acid in Phosphates.	Nitrogen in Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in: 15 mins. at 80° Fahr.	Oxygen, Absorbed in: 4 hours at 80° Fahr.	Hardness, Clark's Scale, in degrees: Before Boiling.	Hardness, Clark's Scale, in degrees: After Boiling.	Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
Kent Co.	Aug. 15	c. blue	none	1·43	none	·16	·0012	·0023	·002	·016	20·2°	5·3°	33·2	satisfactory	Wigner & Harland.
New River	,, 15	clear	none	1·12	trace	·12	·0015	·0027	·010	·020	13·5°	3·0°	18·0	satisfactory	B. Dyer.
East London ..	,, 15	c. yell. green	none	1·20	none	·08	·0031	·0047	·012	·040	13·6°	3·3°	20·4	veg. deb. mycel. fib. anim.	Wigner & Harland.
Southwark & Vauxhall ..	,, 15	c. pale yell.	none	1·24	trace	·14	none	·0056	·039	·062	14·0°	3·0°	19·6	satisfactory	John Muter.
West Middlesex	,, 24	yellow	none	1·12	trace	·10	·0027	·0058	·025	·045	12·0°	3·0°	17·7	none	O. Hehner.
Grand Junction	,,	p. straw		1·14	trace	·18	·0004	·0071	·008	·089	13·7°	3·6°	20·2		A. Wynter-Blyth.
Lambeth	,, 15	c. pale yell.	none	·96	trace	·13	none	·0056	·038	·060	15·0°	3·0°	19·6	satisfactory	John Muter.
Chelsea*	,,														A. Dupré.
Birmingham ..	Aug. 3	s. turb. grnsh.	none	1·33	traces	·21	·1014		·020	·061	8·8°	7·7°	16·8		A. Hill.
Brighton......	,, 9	yel. green clear	none	1·91	none	·20	·0014	·0011	none	·008	12·4°	5·6°	24·8	veg. deb. mycel. anim.	Wigner & Harland.
Bristol........	,, 13	grnsh. yell.	none	·79	none	·18	·0003	·0090	·063	·117	6·5°	2·2°	10·6	sand, algæ, &c.	F. W. Stoddart.
Broadstairs....	,, 15	p. blue clear	veg. mtr.	7·59	trace	·37	trace	·0040	·008	·012	17·2°	5·0°	39·0	veg. deb. mycel. fib. anim.	R. H. Harland.
Cambridge	,, 24	c. p. blue	none	1·40	traces	·41	none	·0028	none	·018	17·0°	5·0°	24·7	satisfactory	J. West Knights.
Croydon	,, 19	f. green	none	1·19	traces	·38	none	·0050	none	·007	15·5°	6·0°	23·0	none	C. Heisch.
Edinburgh	,, 17	s. brown	none	·80	none	trace	trace	·0040	·012	·075	4·4°	4·2°	5·5	none	J. Falconer King.
Exeter........	,, 15	f. green yell.	none	·84	trace	·28	none	·0056	·025	·040	2·8°	2·8°	6·3	satisfactory	F. P. Perkins.
Hastings......	,, 15	greenish	none	4·80	trace	·12	·0021	·0042	·004	·010	7·0°	4·0°	21·6°	satisfactory	H. F. Cheshire.
Dublin........	July 31	clear	none	·89	trace	traces	·0016	·0050	·0600	·2300	1·3°	·6°	4·5	satisfactory	C. A. Cameron.

SOCIETY OF PUBLIC ANALYSTS.

Analyses of English Public Water Supplies in August, 1882. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Date when drawn.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine in Chlorides.	Phosphoric Acid in Phosphates.	Nitrogen in Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in		Hardness, Clark's Scale, in degrees.		Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
									15 mins. at 80° Fahr.	4 hours at 80° Fahr.	Before Boiling.	After Boiling.			
Liverpool	Aug. 23	yell. green	v. slight	1·15	traces	·04	·0014	·0011	.014	·050	4·5°	4·0°	8·5		A. Smetham.
Maidstone—															
Wtr. Company	,, 15	p. grnsh. blue	none	2·60	trace	·51		·0014	·023	·032	18·8°	7·1°	32·3	none	M. A. Adams.
Public Conduit	,, 15	p. blue	none	2·80	trace	·54		·0010	·014	·023	18·4°	6·9°	32·8	none	M. A. Adams.
Manchester ..	,, 21	s. turb. f. yell.	none	·73	none	none	·002	·0065	·059	·109	2·0°	1·9°	5·0	satisfactory	W. Thomson.
Margate	,, 18	yell. green	none	26·41	none	·43	·0066	·0094	·020	·036	20·8°	7·4°	80·1	veg. deb.	G. W. Wigner.
Northwich	,, 8	grn. yell. s. turb.	none	2·70	h. traces	·10	·0007	·0016	·019	·031	14·0°	11·0°	21·0	veg. deb., diat., movg. org.	C. M. Blades.
Norwich	,, 10	p. grnsh. yell.	none	2·00	traces	·07	traces	·0054	·053	·070	11·2°	3·9°	16·5		W. G. Crook.
Nottingham ..	,, 15	green blue clear	none	1·26	none	·46	·0014	·0029	·010	·020	10·0°	7·4°	17·2	veg. deb., mycel. fib. anim.	Wigner & Harland.
Portsmouth ..	,, 12	clear	none	1·25	traces	·23	traces	·0032			11·3°	2·1°	18·5	veg. deb., diatoms	W. J. Sykes.
Rugby	,, 19	c. p. yellow	none	1·24	h. trace	·02	·0070	·0210	·028	·100	17·5°	7·5°	28·1	veg. deb., diatoms infus.	A. P. Smith.
Salford	,, 15	c. s. yellow	none	·60	none	trace	·0009	·0010	·001	·015	3·0°	2·5°	4·0	none	J. Carter Bell.
Swansea	,, 22	v. s. turb.	none	·80	s. trace	none	·0003	·0042	·003	·004	1·0°	1·0°	3·3	none	W. Morgan.
Whitehaven ..	,, 4	c. f. green	none	·42	none	·01	none	·0007	·007	·021	·4°	·4°	2·1	veg. deb., diatoms	A. Kitchin.
Worcester	,, 9	p. yellow	slight	3·75	trace	·17	·0010	·0072	·105	·145	13·9°	6·6°	20·3	veg. deb.	W. E. Porter.

Abbreviations:—c., clear; f., faint; h., heavy; p., pale; v. h., very heavy; v. s., very slight.

ERRATA.—In the August Table, Exeter Water unfiltered, the figures for Oxygen absorbed in 4 hours should be ·114 instead of ·011.

* As the Chelsea Analysis has not reached us up to the time of going to press, it will be inserted in the October number.

REPORTS ON ADULTERATION IN THE STATE OF NEW YORK,

From the *Sanitary Engineer*, New York.

(Continued from page 145.)

CHOCOLATE AND CHICORY.

Five samples of chocolate were examined, but none of them were considered as adulterated, because the commercial article is sold as a mixed preparation containing chocolate. Of three samples of chicory, one was found to contain caramel.

METHODS OF EXAMINATION.

No detailed description of the methods employed was considered necessary, inasmuch as they were those well known to chemists and microscopists. "The search for foreign vegetable substances in the spices, coffee and tea can depend only in a limited degree on chemical analysis, since many of these substances, however widely different in general appearance, and even in origin, are but slightly differentiated in their chemical properties." There is great variety, however, in the structure of the tissues, and practice in the recognition of structural characters of the genuine article enables a ready detection of foreign substances. In detecting the adulterations of coffee, the presence of leguminous and farinaceous substances may often be recognised by their softening more readily in water.

SPICE MIXTURES.

In addition to the samples of food articles already mentioned, a considerable number of the so-called spice mixtures were examined. "It is probably not so widely known as it should be that the demand for the materials for adulteration has called into existence a branch of manufacturing industry of no insignificant magnitude, having for its sole object the production of articles known as 'spice mixtures,' or 'pepper dust.' The use of 'pepper dust,' or as the article is commonly designated in the technical language of the trade by its abbreviation, 'P.D.,' is a venerable fraud."

"The manufacture of 'P.D.' is now a regular branch of business, and the original and specific term 'pepper dust' has expanded with the progress of inventive art to generic proportions, until now we have as well-known articles sold by the barrel 'P. D. pepper,' 'P. D. ginger,' 'P. D. cloves,' and so on through the whole aromatic list. When it is considered that these imitations, lacking only such flavouring with the genuine article as the dealer thinks necessary to make his goods sell, are sold at from three to four cents a pound, and the retail price paid by the consumer is compared with it, the strength of the temptation to engage in such practices is clearly seen. When manufacturers openly advertise themselves as assorters and renovators of merchandise, and openly propose to cleanse musty and damaged beans by a new and patented process, it is full time that its significance should be considered by the public."

MANUFACTURED FOOD ARTICLES.

In the progress of this investigation, the subject of permitting the manufacture and sale of certain articles deprived of some of their natural constituents, or with the addition of certain substances, has frequently occurred. For example, mustard is deprived of its fixed oil in the process of manufacture, and is improved for all ordinary uses thereby. A similar practice is now extensively applied to cloves, which are not likewise improved, but robbed of the very constituent on which their value depends. It is proposed to sell mixtures of chicory and coffee as such, stating the proportions of each on the package, so that no one shall be deceived.* To this, and in fact to all similar propositions, it is to be objected that advantage would immediately be taken of the fact that it would generally be difficult in the extreme, and in some cases absolutely impossible, to establish the fact in a court of justice whether a fixed proportion had been exceeded or not. Bearing in mind the wide difference between the case of demonstrating, often by diverse methods, the fact of the presence of a foreign body, and the difficulty of

[*As to this we may refer our readers to the new Regulations on p. 159.—Ed. ANALYST.]

demonstrating its percentage by weight, it will be plain how greatly the administration of the law would be simplified which should prohibit the manufacture and sale of all mixtures, leaving to the individual the task and pleasure of suiting his own tastes. Protection and even endorsement is claimed for some of these most worthless mixtures on the ground that they are not poisonous, that they are harmless, while the fact that they are counterfeits, as really as is a fictitious bank-bill, is studiously concealed. The simple way and the best way is to require things to be called by their right names.

Group VI.

Sugars; Syrups; Molasses; Glucose; Confectionery; Honey, and Soda Water Syrups.

Report by W. H. Pitt, M.D., of Buffalo, N.Y.

GLUCOSE.

The larger part of this report is devoted to the subject of glucose, or starch sugar. Although this substance has been manufactured in the countries of Europe for the past thirty or forty years, it is only within a comparatively short time that it has found a market in the United States. "Physiologically considered, glucose, pure and uncontaminated with other compounds, is certainly a good and wholesome food." In 1811 a Russian chemist discovered that if starch is boiled with dilute sulphuric acid a part of it is converted into sugar; "and from that time to the present, notably in Austria and Germany, the manufacture of glucose has been carried on with varied success." An idea of the extent of this industry is gained when we learn that two factories in the city of Buffalo consume 14,500 bushels of coal daily, and give employment to 1,200 men. There are also large factories in Chicago, St. Louis, and Peoria.

In the manufacture of glucose, only a part of the starch is converted into sugar, the remainder becoming dextrine, or starch gum. It is therefore hardly possible to make two samples of glucose containing a like amount of saccharine matter. After the removal of the glucose from the solution, the dextrine can be converted into sugar; but the expense of separating the two substances makes the operation very unprofitable.

The process of manufacturing glucose consists in steeping the corn for 50 or 60 hours in water until it is soft, after which it is ground and passed through sieves to separate the coarser material. It is then treated with caustic soda to remove nitrogenous substances, and washed to remove the alkali. The conversion of the starch into glucose is effected by heating the material to about 212° F. and adding from 1½ to 2 per cent. of sulphuric acid; after three hours of boiling the operation is finished. Chalk is then added to neutralize the acid, and after the sulphate of lime has settled, the sweet liquor is drawn off, filtered, and evaporated to 40° B. This is mixed with 5 to 25 per cent. of cane syrup and sold by grocers. By analysis, it was found to contain 18·8 per cent. of water, 34·6 per cent. of dextrine, 7·8 of cane sugar, and 37·8 of glucose. The confectioners' glucose is made in the same way, but with additional purification. The solid glucose is made in copper converters under pressure. One sample contained 68 per cent. of glucose and 14 per cent. of dextrine.

SUGAR.

Fifteen samples of sugar purchased in New York city, were submitted for examination. Water, ash, glucose, and cane sugar were determined, but no attempt was made to ascertain whether artificial glucose had been added. The result of these analyses are given in tabular form. The percentage of water varied from ·8 to 5·1; that of the ash from ·036 to 1·1; and that of the glucose from ·89 to 7·7. The cane sugar was calculated by difference. One sample of sugar contained no glucose whatever; and from the low percentage of this substance in the other samples, it is inferred that none of them had been adulterated.

MAPLE SYRUP.

Three samples were examined, two of them were found to be pure, while the third, which is manufactured in Chicago and largely sold in this state in cans, marked "Pure Vermont Maple Syrup," contained 35 per cent. of artificial glucose.

HONEY.

Three samples of honey were examined. Two were found to be pure, while the third, labelled "White Clover Honey," contained 50 per cent. of artificial glucose.

CONFECTIONERY.

Attention is called to the fact that some of the candy now made is composed almost entirely of glucose, while the common stick candy is often adulterated with 7 or 8 per cent. of artificial glucose. With regard to poisonous colouring matter, it is stated that, of ten samples of yellow candies examined, seven contained chromate of lead. In one instance terra alba was found to the extent of from 10 to 15 per cent. Some black cough-drops contained a large amount of powdered charcoal.

(To be continued).

ANALYST'S REPORT.

At last week's meeting of the Dudley Guardians, Dr. Hill, of Birmingham, sent a letter to the board as to the result of his analysis of what was supplied to the house under the name of butter. No. 1 was butterine, and contained but 10 per cent. of butter fat; No. 2, about 20 per cent. butter fat; and No. 3 was butter, with 19·1 per cent. of water, or 7 per cent. more than was allowed in good butter. The foreign fats in Nos. 1 and 2 appeared to be cotton seed stearine. The master was appealed to as to his statement that he knew it was butterine all the quarter, and he now said that he based his opinion as to its being butter or butterine by the tubs and the brands on them. A letter from the contractor, Mr. Brown (Dudley), was read, and in this he said that only on one occasion had butterine been sent, and that was by a mistake of the assistants. He regretted that the board had jumped to the conclusion that butterine had been supplied all the quarter. There was a long discussion on the subject, and the Guardians generally believed that Mr. Brown should pay the analyst's fee, and the difference between the price of butter and butterine. Ultimately the matter was referred to the visiting committee.

AMERICAN MUSTARD.

Attention has recently been called to the very general practice of the adulteration of mustard. It has long been known in the trade that it is almost impossible to obtain ground mustard entirely free from adulteration, and now that the attention of the public has been called to the matter, it is hoped the State Board of Health will decide whether any admixture of any other substance as an adulterant is admissible and to what extent. There is no better excuse for adulterating this article to be used as a condiment, than to cheapen its price; and for medicinal purposes any addition, such as is ordinarily found, is deleterious and without a redeeming feature. The foreign brands, so extensively sold in our drug and grocery stores, are nearly all adulterated, and should never be used for medicinal purposes. It is this fact of universal adulteration of this article that has made the plasters of one or two prominent manufacturers so popular, as they have been careful to make them of pure materials, and are for that reason far superior to those made by the most careful of nurses.—*Oil and Drug News.*

ERRATA.

American Cheese.—In Dr. Vieth's paper in our last issue the decimal point is wrongly inserted before the proportions of butter fat and foreign fat in the fat analyses, which should be—

FAT OF CHEESE CONTAINING LARD.

Butter Fat	63·0 per cent.
Foreign Fat	37·0 ,,

FAT OF CHEESE CONTAINING OLEOMARGARINE.

Butter Fat	46·0 per cent.
Foreign Fat	54·0 ,,

Mr. Hehner's Milk Analysis Table.—On page 131, in the fourteenth analysis from the top, the amounts of fat and solids not fat are given as 2·72 and 8·31. They should be 3·72 and 7·31.

LAW REPORTS.

Gin Adulteration.—Important Judgment:—

Recently John Selby Nesbitt James, landlord of the "Camel" public house, Philip Street, ingsland Road, appeared to an adjourned summons, at Worship Street Police Court, for selling n adulterated 43½ per cent. below proof, being 8½ below the minimum standard. The case ad been adjourned for evidence on the question as to whether two notices said to be in he bar that all spirits sold were adulterated were really conspicuously placed, the parish inspector aying that he did not see any such notice. After some evidence, Mr. Hannay said that on e facts and the evidence of the inspector he thought a conviction could proceed. The mere fact of ich notices being in the bar was not enough to take the offence out of the Act. The defendant, owever, appeared to have bonâ fide believed that he was protected, and therefore there would be no onviction. The defendant asked the magistrate how he could protect himself. Mr. Hannay said the ct required the article to be labelled, but if that were not possible the customers should be told that it as below standard strength.

A Somerset House Cow:—

At the Sevenoaks Petty Sessions, recently, Bailey Brown, a farmer, of Westerham, Kent, was harged with cruelly illtreating a cow on the 4th ult. Superintendent Okill stated that on the day in uestion he inspected a cow-shed belonging to the defendant, situate at Mapleton Farm, Westerham. a barn he saw a cow slung by means of the shafts of a wagon. The animal was in a very emaciated ondition, and suffering from a compound fracture of one leg. An attempt had been made to reduce e fracture by placing a bandage round it. He called Brown's attention to the state of the cow, whereupon he replied that its leg had been broken for six weeks, and that he had had cows in a similar way, d was under the impression that the bone would join. He succeeded in persuading the defendant to ave the cow shot. When the carcase was lowered from the sling witness noticed that there was a ound in the breast about ten inches each way and six inches deep. The iron bound portion of the afts had been completely embedded in the wound. This was caused from exhaustion and the animal sting on the iron. Mr. Ashton, a veterinary surgeon, stated that the animal must have suffered tensely for some time. Another witness said the cow gave seven or eight quarts of milk up to the last. fter some consideration the magistrate convicted the defendant, and imposed a fine of £5 and costs—together amounting to £8 4s.

Mustard Adulteration:—

At the County Petty Sessions, Gloucester, last month, the case against Mr. William Short, ocer, for selling adulterated mustard, was after two adjournments brought to a termination fore a full bench of magistrates, Sir William Guise in the chair. Mr. Chipp, the Deputy hief Constable, said when the matter was first brought forward he produced the County nalyst's certificate that the mustard was adulterated to the extent of 40 per cent. Mrs. hort, who then appeared for her husband, pleaded that she had purchased the mustard as re. In accordance with instructions from the Bench he (Mr. Chipp) had visited the wholesale house Gloucester which had supplied her, and had inspected the invoice, and the house had sold the mustard pure. The firm who supplied the wholesale house had been written to, and a sample of Mrs. Short's, der seal, had been sent by him to the firm, and they admitted that the County Analyst's certificate as correct, but stated that the sample was not of their mustard. The firm also threatened to bring an tion against anyone who mentioned their name in court. Mr. C. Morris, of the firm of Messrs. erry and Morris, of Southgate Street, Gloucester, admitted that the mustard was sold to Mrs. Short pure, but the firm with whom they dealt warranted it to them also as pure. The chairman (Sir illiam Guise) said that the tradesman had written to him with regard to the remarks he made a short me ago on the difficulty in getting pure mustard in Gloucester. He now repeated that from his own owledge it was an absolute difficulty to obtain pure mustard. The proper colour for mustard was a ownish yellow, and if it was yellow it was a sign that something had been mixed with it. The fference between the mustard which he had at his club in London and that which he had in Gloucester as palpable to anyone who tasted it. With regard to the case before the Bench against Mr. Short ere was not sufficient evidence to convict, and it would consequently fall to the ground.

Coffee and Chicory:—

At Ramsgate Police Court, lately, Mr. John Louth, grocer, 40, Harbour Street, Ramsgate, as charged under the Food and Drugs Act with selling coffee of quality other than that demanded, on

June 22nd last. Mr. Burrows appeared for defendant, who pleaded not guilty. H. Herd, a gardener, said he was employed by Mr. May, Inspector of Nuisances, on June 22nd last, and remembered going into defendant's shop in Harbour Street. He asked for a quarter of a pound of 1s. coffee, for which he paid 3d., and handed it to Mr. May, who came into the shop. Nothing was said to witness about it being a mixture of coffee and chicory, and his attention was not called to a label. He saw Mr. May divide the sample in three parts in defendant's presence, and heard him say he should send it to the Public Analyst. Edward Stephen May, Inspector of Nuisances to the Ramsgate Improvement Commissioners, said he sent the previous witness into defendant's shop in Harbour Street on June 22nd last to ask for a quarter of a pound of coffee. He left the price entirely to the witness, with the exception that he was not to pay a very high price. Herd handed it to him at the shop-door, and pointed out a young man named Henry Austen as the person who had served him, and said he had paid 3d. for it. He (Mr. May) told the young man he should have it analysed by the Public Analyst, defendant being present at the time. Witness then divided it into three parts, one of which he left with defendant and one he delivered to Mr. S. Harvey, the Public Analyst, at Canterbury. He produced the portion retained. Witness afterwards received the certificate from Mr. Harvey, dated July 19th, stating that the sample No. 56 was adulterated with 67 per cent. of chicory. Mr. Burrows said that Mr. May's agent went into the shop and asked for a quarter of a pound of 1s. coffee, and he obtained what he asked for. Everybody must know that coffee at 1s. per lb. would not be pure. He admitted that 1s. coffee was two-thirds chicory and one third coffee, and as the paper in which it was wrapped had the words "This is sold as a mixture of coffee and chicory," as required by the Food and Drugs Act, on it, he (Mr. Burrows) contended that the law had been complied with, and that the defendant had not sold the coffee fraudulently for the sake of gain. The magistrates retired to consider the case, and on their return the chairman said it had failed and would be dismissed. A similar case against Messrs. Vye and Son was withdrawn.

Hislop and Mackwood v. Coston.—Action to recover value of Adulterated Flour:—

In the City of London Court, before Mr. Commissioner Kerr, plaintiffs, who are corn merchants in Seething Lane, sued the defendant, a baker in Harrow Road, for the sum of £9 2s. 6d., being the value of five sacks of flour bought by him at 36s. 6d. per sack. The defence was that the flour was not according to sample, and besides was not of a quality fit for making into bread. The case was adjourned on the first hearing in order that the flour might be analysed, and Mr. A. W. Stokes, Public Analyst, Harrow Road, now reported as follows: "I have examined a sample of the flour and also of the bread. The flour was of a dark colour and musty smell, with bitter taste. Microscopically it was found to consist very largely of the husk or outer part of the wheat grain, such as is not present in flour of a good quality. The bread was almost as dark as that made from whole meal, and was of a very disagreeable taste and smell. In my opinion the flour is of exceedingly inferior quality, utterly unfit for making white and wholesome bread. No care on the part of the baker could produce a sweet and white loaf from such a sample of flour." For the plaintiffs it was urged that they were not millers, that the price was 10s. per sack below the ordinary market rate, and that they did not know for what purpose it was to be used. His Honour: But they knew the defendant was a baker. Mr. Hislop: Yes; but bakers very frequently buy that low-class flour in order to make it into ginger-bread. His Honour: If that is the case I should like to have all persons guilty of such a practice tried for adulteration. I find for the defendant, with £2 1s. costs, inclusive of one guinea for the analyst.

Cocoa and Chocolate Mixtures:—

At the Ramsgate Police Court before H. Curling, Esq. (in the chair), H. B. Hammond, Esq., K. W. Wilkie, Esq., H. Weigall, Esq., H. J. Johnstone, Esq., and General Sir W. M. Coghlan, K.C.B., Pilcher Page (Messrs. Crux and Page, grocers, 13, King Street) was summoned for selling to the prejudice of Edward Stephen May a certain article of food, to wit cocoa, which was not of the nature, substance, and quality demanded, on the 22nd June. Mr. Ambrose Haynes, solicitor of Wandsworth, instructed by Messrs. Fry, the chocolate manufacturers, appeared for the defendant who pleaded not guilty. H. Herd, a gardener, said he was employed by Mr. May on the 22nd of June last, and went to the defendant's and asked for a quarter of a pound of cocoa. The assistant enquired what price? mentioning the different prices. He said he had some at a 1s. and witness said that would do. The cocoa was weighed and put into paper and witness paid the assistant 3d. for it. He then called Mr. May into the shop and informed him what he had purchased, upon which Mr. May told the person who served him that he intended to have it analysed by the Public Analyst. S. May, inspector of nuisances for Ramsgate, said

n the 22nd June he instructed the last witness to go into defendant's shop, and ask for a quarter
ound of cocoa. After the purchase, he went in and the previous witness handed him the cocoa
hich he had been supplied by the assistant. He (witness) told the assistant that he intended to
he cocoa analysed by the Public Analyst, and divided it into three parts, one of which he left with
ller, one he took to the Public Analyst the following day, and the other he now produced. They
ll respectively numbered 54, and were fastened up and sealed in the presence of the seller.
ss now produced a certificate, signed by the Public Analyst, Mr. S. Harvey, of Canterbury, which
that the sample marked 54 was adulterated with at least 43 per cent. of starch and sugar.
ss said he would like to add that after he left the shop, defendant followed him and informed him
hat he had been served with was chocolate powder. He replied that that was not the article
ded. Cross-examined: He had not seen Mr. Page until then. He knew Fry's were large
acturers and highly respectable people. He was aware that chocolate powder was sold for cocoa
was quite against the meaning of the Act. Mr. Haynes reminded witness that it was for the
to expound the meaning of the Act and not him. This concluded the evidence for the prosecu-
nd Mr. Haynes, in defence, submitted that the case which had been put before them wholly failed
g his client within the section of the Act of Parliament for contravening which a very high
y might be imposed. He appeared there for Messrs. Fry who, upon hearing that their customers
en summoned for selling their chocolate as cocoa, instructed him, and he was there to submit to
Worships that there was no evidence brought forward to show that Mr. Page was guilty of the
imputed to him, namely that he did unlawfully sell to the prejudice of Edward Stephen May a
article of food, to wit cocoa, which was not of the nature, substance, or quality demanded. The
ce on the contrary showed that Mr. May was not the purchaser, and that the witness Herd was,
had sworn that he purchased and paid for the cocoa. Mr. May certainly came in and divided the
ate powder into three parts, but he (Mr. Haynes) submitted that he was not the purchaser within
aning of the Act of Parliament. They would find in the Act that in any sale of food or drug no
should be deemed to have been committed 'in any of the following cases,' and it was one of
which would, he contended, exempt his client from a penalty. The sub-section he alluded to was,
re any matter or ingredient, not injurious to health, has been added to the food or drug, because
me is required for the production or preparation thereof as an article of commerce in a state fit
riage or consumption, and not fraudulently to increase the bulk, weight, or measure of the food
g, or to conceal the inferior quality thereof." There was no evidence to show any fraudulent
ion on the part of Mr. Page; and there was also no evidence to show that starch or sugar were
us to health, or that they were put in to increase the bulk or weight, or to conceal any inferiority.
g referred their Worships to a case in Stone's work, Mr. Haynes proceeded to comment upon the
at only cocoa was asked for. This chocolate powder, he said, was as much known as cocoa; and
mitted that the case came clearly within the sub-section to section 6 of the Act which he had
. The Bench retired to consider the points submitted, and upon their return the Chairman said
nch thought Mr. Haynes had better go on with his case. Defendant was then called. He stated
e dealt with Messrs. Fry, and that their powder was as much known as cocoa or chocolate. The
price of cocoa nibs, unprepared and unground, was 1s. 8d. per lb. The chocolate powder was
, and was prepared so that it could be mixed at once. People could not do this with pure cocoa,
required stewing. It was customary to stew it one day and drink it the next. "Fry's soluble
ate powder" was an article of commerce, made to suit the public purse and the public taste.
was nothing injurious in starch or sugar. By the Chairman: He (witness) had never seen pure
sold in powder. Cross-examined: He received the cocoa from Messrs. Fry and Son exactly as it
ld. He was not told by them the percentage of starch and sugar. They sold quite as much as
as they did chocolate powder. Frederick Maxted, of 19 and 21, Harbour Street, said he dealt with
. Fry and Son. Their soluble chocolate powder was an article of commerce, and sold in large
ties. The article was as well known as loose cocoa as chocolate powder. By the Chairman:
ever heard of pure cocoa sold in powder. Cross-examined: Did not think 43 per cent. of starch
gar would increase the bulk or weight of the cocoa. People did not calculate upon getting pure
at 1s. per lb. Their Worships retired, and upon their return into Court, the Chairman in
sing the case, said the Bench did not think there was any fraudulent intention upon the part of
fendant.

ilar summonses against Mr. Frederick Maxted, of Harbour Street, and Mr. Edward Lord, of
gton Street, were then withdrawn by Mr. May.

RECENT CHEMICAL PATENTS.

The following specifications have been recently published, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

No	Name of Patentee.	Title of Patent.	Price
1881			
5286	A. R. Sennett	Production of the Electric Light	6d.
5310	E. Cary, H. Gaskell, and F. Hurter	Purification of Alkaline Solutions	6d.
5536	J. H. Gordon	Dynamo Electric Machines	6d.
5566	A. Miller	Producing Electric Currents	2d.
5593	L. S. Powell	Dynamo Electric Machines	6d.
5660	L. S. Powell	Electric Lamps	6d.
5604	E. B. Burr, and W. T. Scott	Galvanic Batteries for Electric Lighting	6d.
5617	J. H. Johnson	Production of Cyanides of the Metals, of the Alkalies, and Alkaline Earths	4d.
5623	C. A. Carus Wilson	Measuring Electric Currents	4d.
5631	J. S. Sellon	Secondary Batteries	2d.
5650	P. and F. M. Spence	Manufacture of Alum	4d.
5651	St. G. L. Fox	Electric Current Meters	6d.
5667	S. A. Varley	Collection and Distribution of Electric Currents	6d.
5668	Sir W. Thomson	Dynamo Electric Machines	1/10
5697	P. T. J. Voltmer	Production of Artificial Human Milk	4d.
5702	J. W. Swan	Sockets or Holders for Electric Lamps	6d.
5738	J. G. Lorrain	Electric Lamps	4d.
1882			
14	A. Mackie	Apparatus for Electric Lighting	6d.
29	D. G. Fitzgerald, C. H. Biggs, and W. Beaumont	Secondary Batteries	2d.
40	W. R. Lake	Manufacture of Grape Sugar	4d.
72	R. Kennedy	Secondary or Reversible Electric Batteries	2d.
94	J. W. Culmer	Manufacture of Sugar	2d.
95	W. J. Mackenzie	Electric Lamps	6d.
109	W. Weldon	Manufacture of Soda	4d.
120	J. E. Liardet, and T. Donnithorne	Storing Electrical Energy	8d.
132	E. Edwards	Manufacture of Manure from Waste from Distilleries	2d.
134	J. H. Johnson	Treatment of Animal Refuse for Manufacture of Animal Fat	4d.
144	H. J. Haddan	Secondary Galvanic Batteries	2d.
185	H. J. Haddan	Electric Accumulators	2d.
196	E. G. Brewer	Manufacture of Wine from Beetroot	4d.
202	A. McDougall	Treating Solutions Containing Compounds of Ammonia	4d.
224	W. R. Lake	Electric Lighting Apparatus	6d.
319	J. S. Sellon	Construction of Secondary Batteries	2d.
1063	H. H. Lake	Process of Extracting Metals from their Ores	6d.
1437	S. Cohné	Electric Accumulator	4d.
1591	H. H. Lake	Manufacture of Starch and other useful Products from Maize	1/2
1848	W. R. Lake	Manufacturing Crystalline Anhydrous Grape Sugar	4d.

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; Journal of Applied Science; The Provisioner; The Practitioner; New Remedies; Proceedings of the American Chemical Society; Le Practicien; The Inventors' Record; New York Public Health; The Scientific American; Society of Arts Journal; Sanitary Engineer of New York; The Chemists' Journal; Weekly Drug News; Sugar Cane; Country Brewers' Gazette; The Medical Record; The Canada Lancet; Gas and Water Engineering; The Grocers' Gazette; Columbia School of Mines Quarterly Magazine; London Water Supply, by Crookes, Odling and Tidy; Chemical Review; Report on Operations of Glasgow San Department; Analysis of Accounts of Metropolitan Water Companies, by A. Lass.

THE ANALYST.

OCTOBER, 1882.

NOTES ON THE ACTION OF WATER ON LEAD.

By Alfred H. Allen.

on was recently brought by Mr. J. J. Milnes, a solicitor in practice in Hudders-
gainst the Corporation of that town, for damages resulting from the injury to his
which had resulted from his drinking water supplied by the defendants, and which
ged had a powerful action on lead.

r the plaintiff there were called Mr. Fairley of Leeds, Mr. Jarmain of Huddersfield,
yself, while the defence were represented by Dr. Tidy, Dr. Odling and Mr. Wm.
. It was proved by Mr. Fairley and myself that the water took up lead in one
the proportion of ·5 to ·8 grains per gallon, and these amounts were actually found
water which had stood over-night in the leaden pipes supplying water to the house
plaintiff. A report of Mr. Jarmain, made to the Huddersfield Corporation several
nce, showed that he had pointed out the corrosive action of a certain part of the
sfield water supply on lead, had traced the corrosive tendency to the presence of
s springs containing free sulphuric acid, and pointed out a remedy in the neutraliz-
the free acid by means of lime. A distinct trace of mineral acid having been de-
n the water by Mr. Fairley and myself, it is not surprising that the jury found a
for the plaintiff, subject to appeal on certain points of law.

the trial, there arose the question of the influence the presence of sulphuric acid
on the tendency of water to act on lead, and in the words of an article in the
ical News," "the water in question was admitted to have an acid reaction. This was
sulphuric acid, as was shown by Dr. Tidy." I was not present in Court while Dr.
vidence was being taken and have seen no published account of his examination, but,
hat the proportion of free acid was very small, it would be interesting to learn how
roved to be *sulphuric* acid. That a free acid was present was proved by the fact
water distinctly reddened a solution of Poirier's orange, and, after concentration,
istinctly acid reaction to litmus, but it seems very improbable that the trace of acid
was recognisable by its charring action, and if not how was it proved to be sulphuric
That the free acid originated in the influx of ochreous water containing free sulphuric
ms to be admitted, but what becomes of free sulphuric acid when added to a water
ng several times its equivalent of metallic chlorides? It may reasonably be argued
phates are formed, together with free hydrochloric acid, and, until this view is ex-
tally disproved, most chemists will regard it as probably correct. On evaporation
now that hydrochloric acid would volatilize and a sulphate remain.

w the presence of a small quantity of free hydrochloric acid admittedly increases
ency of waters to act on lead, and is probably the cause of the influence observed

in the case of the Huddersfield water. But on the other hand, Dr. Tidy, Professor Odling and Mr. Crookes were of opinion that sulphuric acid if present in small quantities, must tend to protect the pipes from the action of the water, a thin layer of the insoluble, or at least very sparingly soluble, lead sulphate being formed. How far it is reasonable to expect that such protection would be exerted by very small proportions of sulphuric acid may be gathered from a consideration of the relative solubilities of the oxide, carbonate, and sulphate of lead in distilled water; thus :—

1 part of	PbO	dissolves in	7,000	parts of water	= 9·8 grs. Pb	per gallon.
1 ,,	$PbCO_3$	,,	50,500	,,	= 1·07	,,
1 ,,	$PbSO_4$	,,	22,800	,,	= 2·09	,,

I am unable to find the solubility of basic lead carbonate, but it is probably less than that of the neutral salt.

It appears then from these figures that distilled water in contact with lead and oxygen might take up 9·8 grs. of lead per gallon, but in presence of carbonic acid as in most natural waters, this would be reduced to 1·09 grains. In the presence of free sulphuric acid, however, shewn by Dr. Tidy to be present, the carbonate would be changed to sulphate, and the possible amount of lead in solution, would be *nearly doubled*. It is true that in presence of a very large excess of sulphuric acid (sufficient to convert the water into "dilute sulphuric acid") this solubility of lead sulphate is somewhat diminished, but that is a state of affairs which does not apply to the Huddersfield water, respecting which the three high scientific authorities quoted expressed an opinion leading the jury to infer that the presence of a trace of free sulphuric acid was rather beneficial than otherwise, as it would "tend to protect the pipes from the action of the water."

But experiment on such a subject is better than theory, and hence I submit the following data on the action of lead on water containing different amounts of free sulphuric acid. The experiments were made by adding to four quantities of 250 c.c. of distilled water a definite volume of decinormal sulphuric acid (=4·9 grammes H_2SO_4 per litre). Pieces of sheet lead of equal size, scraped clean immediately before use, were then immersed in the liquids, and the beakers loosely covered and left over night.

Expt. I.—Distilled water without any addition of sulphuric acid acted strongly on the lead. The metal was removed and the white deposit at the bottom of the beaker was dissolved in a few drops of hydrochloric acid, when the water was found to contain 7 grains per gallon of metallic lead.

Expt. II.—To 250 c.c. of distilled water 0·1 c.c. of decinormal sulphuric acid was added. This corresponds to 0·112 grains SO_3 per gallon, or about the quantity of free acid found by Mr. Fairley in the Huddersfield water. The experiment was conducted as in I. when 7 grains of Pb. were found, as in the previous case.

Expt. III.—The sulphuric acid was increased to 1·0 c.c. = 1·12 grains free SO_3 per gallon. The lead appeared little acted on, there being no formation of carbonate, but the water was found to contain 1·75 grains of lead per gallon.

Expt. IV.—5·0 c.c. sulphuric acid added = 5·6 grs. SO per gallon. No apparent action on the lead, but the water contained 1·70 grains Pb. per gallon.

In the first two experiments it must be remembered that in the absence of sulphuric acid the lead was converted into carbonate, and hence was not really in solution in the water, but in experiments III. and IV. it existed as dissolved sulphate.

These experiments were made with distilled water, and consequently under conditions ıt do not occur in practice. Hence the following experiments are of more real value. ey were made side by side with those already described, but Sheffield water was substi- ed for distilled water. Sheffield water is a pure moorland water containing from 5 to 7 ins per gallon of total solids, of which the chlorine is 0·7 grains. The reaction is tral or very faintly acid rather than alkaline.

Expt. I.—Sheffield water without any addition of acid took up a trace of lead,—less n 0·05 grain per gallon. (In a subsequent experiment 0·10 grain was dissolved).

Expt. II.—With an addition of 0·112 grains per gallon of SO_3, a strong trace of d was dissolved, notably more than in Expt. I.

Expt. III.—With 1·12 grains SO_3, 0·28 grain of lead was dissolved.

Expt. IV.—With 5·6 grains SO_3 per gallon, the lead dissolved was 4·9 grains per llon.

In none of these experiments was there any sensible formation of carbonate, and only clear liquid was used for the determination of lead. It will be seen that the presence sulphuric acid, even in very small quantity, notably increases the tendency of the water act on lead. The repetition of the experiments always furnishes results pointing in the ne direction, but the actual figures vary from time to time, being probably influenced by iations in the composition of the water. Thus, previously to the trial, I found the lition of 0·224 grs. SO_3 to 1 gallon of Sheffield, caused the solution of 0·6 grains of d per gallon in 24 hours, though the unacidulated water dissolved a barely perceptible ce of lead in the same time. It was to this experiment that I referred in court, as ving that the addition of a trace of sulphuric acid to a pure water (not distilled water) reased its tendency to act on lead.

Since the date of the trial a death has occurred at Keighley which is suspected by medical men to be due to lead-poisoning through the medium of water. The deceased s in the habit of drawing a glass of water from the tap the first thing in the morning, d by drinking this he would necessarily introduce into his system any lead dissolved m the pipes during the night. In his liver I found lead. The water which had been nding in the lead pipes all night contained 0·61 grains of lead per gallon. Water en from the neighbouring main was free from lead but had a marked acid reaction to rier's orange. Left over-night in contact with clean lead it dissolved from ·42 to ·56 ins per gallon. Rendered faintly alkaline with lime water and left over-night in contact h lead, only 0·14 grains of Pb. was dissolved.

These experiments appear to me to indicate that a trace of free acid is a leading cause the action of water on lead and that the effect can be greatly diminished by tralisation.

Occasionally, during a period extending over many years, I have examined the effield water for lead. At present it is wholly free from that metal, even after standing rnight in the pipes, but not unfrequently I have found notable traces in it. In the light recent researches it is probable that, on those occasions, the water as delivered from the in contained a free acid,—whether sulphuric acid or, as I contend is more probable, lrochloric acid is at present an open question.

Of course the few experiments above described do not wholly clear up the difficult and obscure problem of the cause of the action of water on lead, but they at least indicate the great probability of one of the leading causes, and they help to lay at least one old ghost, and lead to a better understanding of some misinterpreted observations. It remains for others to show, if they can, why sulphuric acid or sulphates should be theoretically held to reduce the tendency of water to act on lead when lead sulphate is more soluble than the carbonates, and why free sulphuric acid should be assumed to exist in water simultaneously with metallic chlorides.

ON ACETATE OF LIME AND ALLIED SUBJECTS.*

By Messrs. Stillwell and Gladding.

METHODS OF ANALYSIS.

1. *Based on the Amount of Soluble Lime Salts Present.*—The value of an acetate of lime depends entirely on the amount of glacial acetic acid present. Two methods of analysis are in use at the present time; one determines the amount of lime salts soluble in water, and by calculation the amount of lime so found is converted into acetate of lime, or glacial acid, as the case may be. This method is based on the supposition that all the soluble lime salts present are acetates; but this is not so. Acetates of lime almost invariably contain caustic lime in slight amount, and if the lime has been overheated, it is present in still greater quantity. Again, organic salts of lime are always present. With improved methods of manufacture, the amount of these has diminished of late years, and the difference between the amounts of acetate of lime found by distillation of the acetic acid and that found from the amount of soluble lime is much less than formerly. The better the sample of acetate, the less is the difference between the results given by the two methods.

In the year 1872 (see *American Chemist*, vol. ii., p. 324, and vol. iii. p. 8), this question of methods of analysis came up. It is necessary to state here the objections raised by certain English chemists against the process of distillation, which was advocated by some American chemists, since the objectors to a distillatory process had no good foundation upon which to rest. But as the general custom of the trade was at that time based upon the method of analysis by means of the soluble lime salts present, we have before and since that date used the term "English Commercial Test," to designate analyses made in this manner, and so state the results on our reports of analysis. Whenever an analysis is made by distillation it is so stated.

2. *Based on the Distillation of the Acetic Acid.*—Three acids may be used in this process of distillation—hydrochloric, sulphuric, or phosphoric.

(*a.*) When *hydrochloric acid* is used, a part of it is carried over with the acetic acid and must be estimated and a correction made. It possesses these two advantages: that it does not act upon the organic matter present, and that the solution of chloride of calcium will permit of the distillation being carried to a low point without danger of error. The distillation is made in a retort connected with a condenser, and the total acids present in the condensed liquid are estimated, and the proper correction applied for the amount of hydrochloric acid found to be present.

* Read before the American Chemical Society.

(*b*.) The use of *sulphuric acid* has three disadvantages.

First.—As it becomes concentrated in the retort during the process of distillation, it acts upon the organic matter present, forming sulphurous acid, which is carried over with the acetic acid and included in the estimation of the total acid power of the distillate. Thus the amount present would be calculated as acetic acid, and the result thereby increased unduly. To prevent such action, resource is had to distillation in a current of steam.—(See *American Chemist*, vol. vi., p. 294.)

Second.—The sulphate of lime formed by the addition of sulphuric acid to the solution of the acetate of lime, is troublesome on account of the bumping which takes place during the distillation. This is partly prevented by the use of a current of steam.

Third.—When a sample of acetate of lime contains *chloride of calcium* or *chloride of sodium*, the chlorine is carried over in the form of hydrochloric acid and neutralises its equivalent amount of the standard soda, used to receive the acid distillate. The amount thus distilled must be estimated and the correction made. To prevent this, the chlorine present is precipitated by the addition of sulphate of silver to the solution of acetate before distillation begins.

(*c*.) *Phosphoric acid* is the best acid for use in the process of estimating acetic acid by distillation. It has three advantages.

First.—It does not act on the organic matter.

Second.—During the distillation, the liquid in the retort is not suffered to fall below 15 cc. in bulk. Under such circumstances, phosphoric acid does not decompose any chlorides of calcium or sodium which may be present in the acetate, thus requiring no addition of sulphate of silver. Only the merest trace of chlorine is carried over, as shown by experiments with a sample of acetate containing nearly 5 per cent. of chloride of sodium and also by trial on a known amount of pure chloride of sodium. This unexpected result merits attention, since in this respect phosphoric acid differs so decidedly from sulphuric acid.

Third.—It forms a perfectly clear solution with the acetate of lime. By the use of a large amount of glacial phosphoric acid, at least five times the weight of acetate of lime taken for analysis; the phosphate of lime first formed is redissolved to a clear solution. The distillation proceeds quietly and uniformly without bumping, and the liquid in the retort is easily kept at any desired point. The use of a current of steam is necessary, both for ease of manipulation and accuracy of results.

After a thorough trial of hydrochloric and sulphuric acids, we discarded both in favour of phosphoric acid, and for some years past have used it to our full satisfaction. It is important that the phosphoric acid should contain no nitric or other volatile acids which would increase the results obtained above the truth. Each new lot of phosphoric acid should be examined for such impurities before use. If it be suspected that any phosphoric acid has been carried over during the distillation, it is easily detected in the distillate by the use of molybdate of ammonia.*

* The objection raised against this method by Dr. Waller, namely, that the presence of acetic acid interferes decidedly with the precipitation of phosphoric acid by the molybdate solution, was answered by Mr. Stillwell to the effect that he overcame the difficulty by using large quantities of ammonium nitrate.

The process of distillation, if carefully and intelligently done, is very accurate. Duplicates made by this method agree with each other fully as closely as do those made by the estimation of the soluble lime. For example, in January last, a sample of grey acetate was analysed by distillation in our laboratory, with a result of 78·22 per cent. acetate of lime. Three months later, the same sample was re-analysed by another man in our laboratory, using fresh standard solutions, and 78·20 per cent. of acetate was obtained. This sample contained 3·16 per cent. of common salt, shell-lime having been used in its manufacture. With care and experience in this method of analysis by distillation, it is not difficult to obtain duplicates which agree to two-tenths of one per cent. of acetate of lime; usually the difference is less than that. A sample of grey acetate analysed recently was distilled with sulphuric acid, and a duplicate with phosphoric acid. The results agreed exactly; the latter distillation, however, requiring less attention than the former, for reasons given above under processes of distillation.

The indicator used for titration is a few drops of a solution of phenol-phthalein, one gramme in 250 cc. of a mixture of equal parts of water and alcohol. We have found this indicator far preferable to either litmus or cochineal; of course, whichever indicator is used, the same must be used both for the standardising and the actual analysis.

To show the need of some uniform and accurate method of analysis, we refer to a note in "Allen's Commercial Organic Analysis," vol. i., p. 205. He finds from experiments made in his own laboratory on the *same sample* of acetate of lime, that results were obtained varying from 47·4 per cent. to 57·6 per cent. of acetic acid. In our own practice for many years previous to the publication of the present, we found differences fully as great between results by distillation and by the various commercial processes; but, as we said before, at the present time the differences are not nearly so great as formerly.

In conclusion, we wish to lay strong emphasis upon the facts that, inasmuch as the process of distillation is the only one which gives the real amount of glacial acid present, and inasmuch as it is an imitation of the actual manufacturing process for obtaining acetic acid from its acetates, it is the most reliable and should be adopted. This position we have maintained for many years, and we notice that, especially in the case of grey acetate, buyers are more and more insisting on the test by distillation. The price should be based on the unit of glacial acid, just as, in fertilising materials, the prices are based upon the units of phosphoric acid, nitrogen, and potash.

In the course of discussion on the above paper, Dr. Grothe asked if the authors had noticed the presence of acetone in the products of the decomposition of acetate of lime by heat.

Mr. Stillwell said he had not noticed it particularly, since his attention had been confined simply to the loss of acetic acid.

Dr. Squibb remarked, respecting the production of acetic acid from wood, that it was not necessary to carbonise the wood, but that all the acetic acid could be obtained at a much lower temperature (about 160 to 200° C.), and the products then contain no acetone. For the analysis of sodium acetate, he uses a glass retort covered with copper gauze, and heats it on one side to prevent frothing and bumping. He uses 10 grms. of the acetate, with 20 cc. of water, and 10 cc. sulphuric acid; after distilling off 10 to 15 cc. of

liquid the distillation is interrupted—about 10 cc. of water are added to the retort, and 10 to 15 cc. of fluid again distilled over. This is repeated a third time, when all the acetic acid will have come over, without trouble from frothing or bumping during distillation.

Dr. Squibb further remarked that he uses in his factory retorts 20 feet long, 2 feet wide, and 10 feet deep, holding 2½ cords of wood, and heats them in a hot air bath. During the first twelve hours, only water is given off. In about twenty-four hours the acetic acid begins to distil over, the process being completed in six to seven days for each retort.

Seasoned oak is preferred, and any admixture of softer woods diminishes the yield of acetic acid. Chestnut is notable in this respect. Throughout the active heating, but more copiously toward the end, a gas, colourless and odourless (and so far as tested, uninflammable), comes over, having anæsthetic properties. This gas adheres to the wood after the charge is cooled and drawn, and seems to be a reason why small vermin will not remain near it. If the charge is heated too long, smoke appears at the exit pipe, and carbonisation of the wood begins at the centre of the top of the charge, extending in V shape towards the bottom. When once started, this carbonisation proceeds spontaneously without further application of heat. Indeed, it is sometimes found difficult to check it, even by the liberal application of cold water to the outside of the retort.

In the course of the operation, when properly managed, the charge shrinks to one-third of its volume. 4,000lbs. of wood yielded about 2,800lbs. of residue. The residue retains all the appearances of the wood before distillation, only that it becomes walnut-coloured, and it has the same elementary composition as that of kiln-dried wood. It is brittle and not well adapted to construction, but forms a most excellent fuel for many purposes, especially for kindling anthracite coal. The distillate is neutralised with soda-ash and distilled to about one-fortieth its volume. The first product is crude wood spirit. This is redistilled, and gives rectified wood spirit, and lastly wood oils, which contain large quantities of furfurol and no acetone. The wood oils are separated by passing the last portions of distillate into water. The rectified wood spirit contains about 80 per cent. of methyl acetate, and when saponified, gives a very pure methyl alcohol. One cord of well-seasoned wood will afford 1,200 to 1,400lbs. of liquid products. A cord of oak yields 60 to 70lbs. of glacial acetic acid. There was no process commercially practicable for obtaining pure acetic acid from pyroligneous acid or acetate of lime, but only from acetate of soda.

Mr. Parker remarked that he had tried a process for making acetic acid by heating wood-fibre with steam, under a pressure of 60lbs. at 275° C., and confirmed Dr. Squibbs's observations on the deterioration of the woody fibre, and also the impracticability of making pure acetic acid from pyroligneous acid.—*New Remedies.*

TAXING OLEOMARGARINE.

The Committee of Ways and Means of the American House of Representatives has made a favourable report on a Bill to "tax the manufacture and sale of oleomargarine." The Bill imposes a tax of 5 dols. on every manufacturer of oleomargarine or other compound in imitation of butter, and a tax of 2 dols. on every dealer in such articles. It also imposes a stamp-tax of 1c. per lb. upon oleomargarine and other spurious butter, and the absence of the proper internal revenue stamp shall be *primâ facie* evidence of the non-payment of the tax thereon, and, in addition to other prescribed penalties, the unstamped packages shall be forfeited to the United States. Other suitable penaltie are prescribed for violation of the law.

ON THE RELATION BETWEEN THE SPECIFIC GRAVITY, THE FAT, AND THE SOLIDS NOT FAT IN MILK.

By E. F. Willoughby, M.B. Lond.

Dr. Vieth has published in The Analyst a rapid method of examining milk as practised by him in the laboratory of the Aylesbury Diary Company. It, or some similar process, is much to be recommended, on the ground that the analyst would be thereby able to make a much greater number of examinations in a given time, and might thus exert a constant control over the milk supply of his district, resorting to the more accurate, but far more tedious processes hitherto employed, whenever the results of the shorter examination indicated, or led him to suspect, adulteration. The specific gravity of milk is, we need scarcely remind our readers, the resultant of two opposing forces—the fat which lowers, and the other solids which raise it above that of water. In Germany, the question of the value of the specific gravity has long been a subject of investigation, and it has recently been studied here by Mr. Otto Hehner and Mr. Wynter Blyth, independently of one another.

Mr. Hehner reasoned that if the percentage of solids not fat S raise the specific gravity G of milk above 1,000 to the amount s, and if each percentage of fat F depress it by the quantity f, then

(1) $Ss-Ff=G$, and we know that

(2) $F+S=T$ (total solids).

substituting in (1) for F its value $T-S$ (from 2)

we have $Ss-(T-S)f=G$

$$Ss-Tf+Sf=G$$

$$Ss+SF=G+Tf$$

and $S=\frac{G+Tf}{s+f}$

that is, we should obtain the percentage of solids not fat, by adding to the specific gravity of the milk (by which term he understands the excess of weight of 1,000 volumes of milk over 1,000 volumes of water) the percentage of total solids, multiplied by the gravity of each percentage of fat, the sum being divided by that of the gravities of one per cent. of solids not fat, and of fat.

If the factors s and f were ascertained, we should be able to infer the proportion corresponding to each in a given sample, of which we knew only the specific gravity and the total solids, and the examinations would be reduced to these simple operations. Dissatisfied with the calculations of Behrend and Morgen and of Clausnitzer and Mayer, Mr. Hehner made a series of careful experiments, in order to ascertain the true value of the factor s in each, drying the residue of 5 grammes of milk for four hours in a water bath, extracting the fat for two hours in a Sohxlet's tube, and drying the exhausted residue for an hour at 100° Cent. The specific gravity he obtained by means of a Sprengel tube, which is for several reasons, very much to be preferred to the old specific gravity bottle. He never found the weighings thus obtained to differ from each other by more than a milligramme, and generally by much less. An average of twenty-two consecutive analyses gave the value s 3·605 that is, each percentage of solids not fat raises the gravity of milk

on an average by 3·605, and this is true even in the extreme cases of skim milk and milk extraordinarily rich in fat. He believes, then, that provided the exact condition of drying and taking the specific gravity are observed in every analysis, we may obtain the percentage of solids not fat, and indirectly of the fat, with sufficient accuracy for all cases which are not to be made the basis of legal proceedings.

The necessary factors are $s=3{\cdot}605$=the amount by which each percentage of solids not fat raises the specific gravity over 1,000, and $f=0.725$=the amount by which each percentage of fat depresses the same, while $(s+f)=4{\cdot}33$, and the calculation is as follows. Multiplying the total solids by 0·725, adding the product to the "specific gravity" as defined above, and dividing the sum by 4·33, we have the percentage of solids not fat, which, subtracted from the total solids, gives the fat.

If any great divergence from the normal percentage be indicated, a complete analysis would of course be made, and a considerable difference between the solids not fat calculated and found, would suggest adulteration with sugar or other body, for which a search would be made.—*Sanitary Record.*

COFFEE MIXTURE IN THE ISLE OF MAN.

At the Tynwald Court, held recently, His Excellency the Hon. Spencer Walpole, Governor of the island, brought up for consideration a supplementary notice, which, he said, had been issued a few weeks ago by Her Majesty's advisers, making a slight change in the revenue laws. The object of this change was, he understood, to prohibit the importation of vegetable matter applicable to the use of chicory or coffee, and to prohibit the sale of any such matter. In consequence of the desire to prohibit their importation, it was necessary to make a slight change in the English tariff, and they had excluded every vegetable matter other than chicory and coffee from the tariff. It seemed to him and to his advisers that if it was desirable in the interests of the consumers of Great Britain to make this change, it must also be desirable in the interests of the consumers of the island. It seemed to him and his advisers that if all vegetable matter other than chicory and coffee were struck out of the Customs laws of Great Britain, it should also be struck out of the Customs laws of the island. If the court agreed with that view a resolution would be laid before them as to what was to be done. The Attorney General stated that by the English Customs law there was a duty on chicory and coffee and every vegetable matter applicable to the use of chicory and coffee. In our Act we had—"that there shall be payable on chicory and coffee, or any other vegetable matter applicable to the uses of chicory and coffee, per the pound one penny." If it were necessary to prohibit the importation and use of such vegetable matter in England, he thought it was necessary to prohibit it there. It would not affect them in the matter of revenue, because they would get the duty on the real articles of coffee and chicory, instead of on imitations. He understood there never was a penny collected there on these importations. He proposed—"Whereas, it is proposed to repeal the duty of Customs payable in the United Kingdom on the importation of vegetable matter applicable to the use of chicory and coffee, and to prohibit the sale of any such matter: Resolved—That in case such duty be repealed, it is expedient that the Customs duty of one penny the pound in respect of any other matter applicable to the use of chicory and coffee payable on the same being imported or brought into this island under the Customs (Isle of Man) Tariff Act 174, Section 1, be repealed, and that the sale of any such matter within this isle should be prohibited. And that His Excellency the Lieutenant-Governor be requested to take such steps as may be necessary to give effect to this resolution." Mr. Clucas seconded the motion, thinking it most desirable the change should be carried out. The motion was unanimously adopted. Replying to Mr. Stevenson, His Excellency presumed the resolution would have effect on the importation of date-coffee. Deemster Drinkwater hoped it would, and the Attorney-General said that if it were an imitation it would be prohibited.

SOCIETY OF PUBLIC ANALYSTS.

Analyses of English Public Water Supplies in September, 1882. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Date when drawn.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine in Chlorides.	Phosphoric Acid in Phosphates.	Nitrogen in Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in		Hardness, Clark's Scale, in degrees.		Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
									15 mins. at 80° Fahr.	4 hours at 80° Fahr.	Before Boiling.	After Boiling.			
Kent Co.	Sept. 11	c. blue	none	1·56	none	·50	·0016	·0025	trace	·006	20·0°	5·6°	31·0	satisfactory	Wigner & Harland.
New River	„ 15	c. f. yellow	none	1·06	trace	·13	·0014	·0014	·009	·025	14·5°	3·5°	18·2	satisfactory	B. Dyer.
East London ..	„ 9	c. yell. green	none	1·27	none	·33	·0017	·0048	·022	·056	13·4°	3·4°	20·2	veg. debris, animalculæ	Wigner & Harland.
Southwark & Vauxhall ..	„ 6	c. pale yell.	none	1·26	trace	·13	·0009	·0035	·028	·050	14·5°	3·0°	19·6	satisfactory	John Muter.
West Middlesex	„ 28	yell. green	none	1·05	trace	·11	·0020	·0035	·025	·049	13·0°	3·5°	18·1	satisfactory	O. Hehner.
Grand Junction	„	p. straw	none	1·24	trace	·16	·0016	·0061	·007	·087	12·1°	3·1°	17·4	satisfactory	A. Wynter-Blyth.
Lambeth	„ 6	c. pale yell.	none	1·26	trace	·13	·0009	·0035	·028	·050	14·5°	3·0°	18·9	satisfactory	John Muter.
*Chelsea	Aug. 31	c. gr. yellow	none	1·22	trace	·16	none	·0056	·002	·053	13·7°	4·0°	17·2	satisfactory	A. Dupré.
Chelsea	Sept. 18	c. gr. yellow	none	1·26	trace	·16	none	·0053	none	·003	13·5°	4.5°	17·6	satisfactory	A. Dupré.
Birmingham ..	Sept. 6	c. blue	none	1·05	trace	·16	·1014		·013	·026	11·9°	7·5°	21·7	none	A. Hill.
Bolton	„ 13	s. yellow turbid	none	·50	none	·02	·0013	·0060	·022	·060	3·6°	3·6°	7·6		W. H. Watson.
Brighton	„ 10	c. grn. blue	none	1·98	none	·35	·0031	·0026	none	trace	12·4°	4·2°	20·4	veg. debris, & animalculæ	Wigner & Harland.
Bristol	„ 11	grnsh. brown	none	·85	none	·17	·0002	·0049	·039	·075	12·0°	2·6°	13·7	veg. deb.	F. W. Stoddart.
Cambridge	„ 18	c. p. blue	none	1·38	trace	·37	none	·0030	none	·015	17·0°	5·0°	24·0	satisfactory	J. West Knights.
Croydon	„ 20	f. green	none	1·19	trace	none	none	none	none	·014	15·5°	6·0°	23·2	none	C. Heisch.
Dublin	„ 4	s. yellow	none	·89	trace	trace	·0020	·0056	·065	·250	1·5°	·7°	4·6	satisfactory	C. A. Cameron.
Edinburgh	„ 15	s. brown	none	·88	none	trace	·0032	·0090	·012	·076	4·2°	3·9°	5·6	none	J. Falconer King.
Exeter	„ 16	f. b. yellow	none	·84	trace	·24	·0007	·0024	·024	·041	2·6°	2·6°	5·6	satisfactory	F. P. Perkins.
Hastings	„ 19	grnsh. s. turbid	none	3·90	trace	·10	·0028	·0056	·008	·015	8·0°	5·5°	29·4	satisfactory	H. F. Cheshire.

SOCIETY OF PUBLIC ANALYSTS.

Analyses of English Public Water Supplies in September, 1882. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Date when drawn.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine in Chlorides.	Phosphoric Acid in Phosphates.	Nitrogen in Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in: 15 mins. at 80° Fahr.	Oxygen, Absorbed in: 4 hours at 80° Fahr.	Hardness, Clark's Scale, in degrees: Before Boiling.	Hardness, Clark's Scale, in degrees: After Boiling.	Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
Liverpool	Sept. 21	green yell.	none	1·22	trace	·04	·0007	·0028	·014	·045	3·7°	3·0°	10·3	satisfactory	A. Smetham.
Maidstone—															
Wtr. Company	,, 14	p. green	none	2·40	trace	·56		·0030	·012	·040	16·8°	6·6°	31·5	none	M. A. Adams.
Public Conduit	,, 14	p. blue	none	2·20	trace	·57		·0010	·006	·015	18·9°	6·8°	32·1	none	M. A. Adams.
Manchester ..	,, 20	s. turb. f. yell.	none	·73	none	none	·0024	·0075	·051	·122	2·0°	1·9°	5·3	satisfactory	W. Thomson.
Nottingham ..	,, 9	c. yellow blue	none	1·34	trace	1·03	·0014	·0021	trace	·040	11·2°	6·8°	16·6	veg. deb.	Wigner & Harland.
Norwich	,, 8	p. grnsh. yell.	none	1·90	trace	·07	trace	·0076	·045	·074	11·0°	4·7°	12·4	veg. deb.	W. G. Crook.
Rugby	,, 6	c. p. yellow	none	1·44	h. trace	·07	·0056	·0109	·032	·088	13·0°	7·0°	18·0	veg. deb., desmids	A. P. Smith.
Salford	,, 2	f. yell. & cloudy	none	·80	none	none	·0007	·0021	·002	·031	3·0°	2·5°	4·5	none	J. Carter Bell.
Southampton..	,,	p. yellow	none	1·05	trace	·14	·0028	·0049	·008	·097	12·0°	4·8°	17·9	diatoms, veg. deb., &c.	A. Angell.
Swansea	,, 25	s. turbid	none	·90	trace	none	·0010	·0042	·003	·004	1·4°	1·4°	3·7	none	W. Morgan.
Whitehaven ..	,, 14	c. f. green	none	·43	none	.01	none	·0007	·009	·019	·4°	·4°	2·0	veg. deb., movg. org.	A. Kitchin.
Worcester	,, 11	p. yellow	none	2·90	trace	·16	none	·0064	·008	·140	13·3°	6·2°	18·8	veg. deb.	W. E. Porter.

Abbreviations:—c., clear; f., faint; h., heavy; p., pale; v. h., very heavy; v. s., very slight.

ERRATA.—In the August Table, Birmingham Water, the Ammonia should be ·0014 instead of ·1014; Worcester Water, the Oxygen absorbed in 15 minutes should be ·0105 instead of ·105.

* Omitted from last month's table.

POTASSIOBISMUTHOUS IODIDE AS A TEST FOR ALKALOIDS.

Dragendorff, in his Manual of Toxicology, recommends this compound as one of the most delicate tests for alkaloids, but adds that it cannot be employed to distinguish one alkaloid from another, as it gives orange-coloured precipitates with most of them. F. Mangini, however, finds that the characters of this reagent vary considerably according to the manner in which it is prepared. When obtained by Russland's process, described by Dragendorff, it produces a turbidity even in pure water; but when prepared by mixing 3 pts. potassium iodide with 16 pts. liquid bismuth iodide and 3 pts. hydrochloric acid, it does not give any turbidity with water, and is an extremely delicate test for alkaloids, serving also to distinguish many of them one from the other by the various gradations of color of the precipitates and their alterations after long standing. The following are the results obtained:—

Strychnine: Light yellow precipitate becoming dark yellow after some time; supernatant liquid remains clear.

Morphine: Reddish yellow precipitate which agglomerates at the bottom; liquid remains clear, precipitate disappearing after a few days if the whole is left at rest, and the liquid becoming canary yellow.

Codeine: Immediate, copious, yellowish-red precipitate, remaining for some time suspended in the liquid, and assuming a light brick-red color when left at rest.

Atropine: Precipitated at first in filaments, but gradually settling down in the form of a reddish-yellow powder, which if left at rest becomes canary yellow, and dissolves after some time, coloring the liquid golden-yellow.

Aconitine: Precipitated at first in flocks, but suddenly forms at the bottom a chrome-yellow pulverulent precipitate, which does not change color when left at rest, whereas the liquid becomes yellow.

Brucine: Precipitated at first in filaments which ultimately settle down with golden-yellow color, becoming paler when left at rest for some time.

Nicotene: Immediate red pulverulent precipitate, which suddenly falls to the bottom, and becomes reddish-yellow when left at rest.

Cicutine: Precipitate similar in character but of darker color, and becoming dirty-white when left at rest.

Solanine: Slowly precipitated with lemon-yellow color, becoming darker on repose and adhering to the bottom of the tube when shaken.

Veratrine: Light yellow precipitate forming slowly, remaining suspended for some time and becoming light canary-yellow when left at rest.

Narceine: Light yellow precipitate forming slowly and remaining suspended like that of veratrine, but of deeper color; becomes reddish-yellow on repose.

Quinine Sulphate: Immediate brick-red precipitate which suddenly falls to the bottom, and becomes dirty-yellow on repose; remains suspended after agitation.

Cinchonine Sulphate: Like the last, but does not fall down so quickly, and acquires a darker color when left at rest.—*New York Weekly Drug News.*

REPORTS ON ADULTERATION IN THE STATE OF NEW YORK.

From the *Sanitary Engineer*, New York.

(Continued from page 164.)

Group VIII.

Wines; Beers; Spirits; and Cordials.

Report by F. E. Engelhardt, Ph.D., of Syracuse, N. Y.

WINE.

By the term "wine," should be understood only pure grape juice, fermented and clarified. Those preparations made from grape juice by other than the ordinary methods of procedure might be designated as "improved wines," to which could be added the name of the person originating the modifications in manufacture. Wines prepared artificially from raisins, cider, &c., with the alcohol, colouring matter, and other substances, should be sold only as "artificial wines."

A good wine should be clear, with a pleasant taste and aroma. A sour taste is always a sign of poor wine. A burning sensation in the throat is generally an indication that alcohol has been added. Dizziness and headache are not produced by drinking pure wine.

Wines are divided into three classes, "dry," "greasy," and "cordial," each having three divisions according to quality.

Under the heading "analysis of wines," Dr. Engelhardt has given the most approved methods for the determination of the specific gravity, alcohol, extract, sugar, acids, ash, glycerine, &c.

In speaking of the sulphuring of wine, it is stated that certain wines are completely bleached by sulphuric acid. The bi-sulphite of lime is sometimes used for a similar purpose. The practice should be condemned, however, as one likely to produce injurious results. The burning of sulphur in wine casks should be done only in cases where it is necessary to remove a musty odour, and even then the cask should afterwards be thoroughly washed.

The principal adulterations of wine are "plastering," "fortifying," and "colouring." The "plastering" of wines consists in adding calcined plaster, either to the unpressed grapes or to the expressed juice during fermentation. The main objection to the practice is that it introduces into the wine a considerable quantity of sulphate of potash, a salt having a purgative action even in small doses. The French Government prohibits the sale of wine which contains over 0·2 per cent. of this salt. "Plastering" is practised in Spain, Portugal, and the south of France.

The "fortifying" of wines consists in the addition of brandy or of French spirits, in order to increase the alcoholic strength of the wine. Wines with more than 20 per cent. of alcohol are "fortified."

The "colouring" of wine is practiced to a great extent and with various substances, either to heighten the colour of a natural red wine deficient in colour, or to make from white wines coloured ones, or finally to colour artificial wines.

A large number of substances are used for this purpose, many of which cannot be considered as injurious, while others certainly are so. Several methods are given for the identification of these colouring materials, but the whole question is one of great difficulty.

Mention is made of the various methods for the so-called inprovement of wines. Chaptal adds sugar to the grape juice before fermentation to increase the alcoholic strength of the product. Gall's method consists in the addition of sugar and water—poor in sugar and rich in acid; while in that of Petiot the pulp and skins of the grapes are repeatedly fermented with sugar-water. Scheele's method, said to be practised by wine dealers in England, Germany, and Austria, consists in the addition of from 1 to 3 per cent. of glycerine to the wine, whereby the wine, if young, appears older, has more body and stability.

The manufacture of artificial wines from raisins, cider, &c., is by no means uncommon in this country, and in Europe. In some countries the artificial product is considered in the same light as the natural wine. A number of recipes are given for the manufacture of these artificial wines.

No samples of wine were submitted to Dr. Engelhardt for examination.

LIQUORS.

Liquors are sugar solutions fermented and then distilled, hence they are also called distilled spirits. They are obtained, first, from liquids containing alcohol, previously formed by fermentation; second, from liquids or solids containing sugar; third, from substances which contain neither alcohol nor sugar, but may be made to yield these products.

Cognac brandy is the distilled spirits of wine, and contains from 48 to 60 per cent. of alcohol. Its quality, like that of all liquors, depends more upon its bouquet and taste than upon the alcoholic strength.

Methods are given for the analysis of brandy, and considerable is said of fusel-oil and its detection. Fusel-oil is a mixture of various alcohols and complex ethers, and each of the distilled liquors has an oil peculiar to itself. It communicates to the liquor a very unpleasant flavour, and if present in any considerable quantity it has an injurious effect on the human system. Several facts and opinions are given, however, which go to prove that the most injurious ingredient of distilled liquors is the alcohol itself, and next comes the fusel-oil.

The chief adulterants of brandy are water and alcohol. This liquor is also largely produced artificially, and a number of recipes are given for its preparation.

Twenty-five samples of brandy were examined by Dr. Engelhardt. The percentage of alcohol varied from 30·8 to 50·4 by volume. None of the samples contained sulphuric acid or chlorides. Sixteen gave a distinct reaction for fusel-oil, six contained only traces, and three none whatever.

The distinguishing characteristics of genuine and artificial brandies lie in the relative quantities of alcohol, extract, ash, acidity, colouring matter and tannic acid, together with the flavour. In the samples examined no indication could be found of the oil of bitter almonds, nitro-benzol, nitrous ether, or other injurious substances.

Whiskey, like brandy, consists of a diluted alcohol, with a peculiar flavour derived from the material used in its preparation, and developed during the process of fermentation and distillation.

Whiskey is manufactured from malt, wheat, rye, corn, or potatoes, and is named either from the material used in its manufacture, or from the country where it was produced. The first step in its manufacture is the conversion of the starch of the raw material into sugar by the action diastase. The resulting sugar solution is fermented and then distilled. Purification is necessary to remove the fusel-oil. The analysis of whiskey is similar to that of brandy.

Whiskey is often made artificially, the same as other liquors, and a number of recipes are given for accomplishing this. The most objectionable ingredients in the artificial whiskies are creosote and sulphuric acid, substances which are recommended in some of the recipes given.

Twenty-five samples of whiskey were examined; and it appears "evident that the addition of water and colouring matter is practised more than any other adulteration." No free sulphuric acid was found in any of the samples. The percentage of alcohol varied from 28·9 to 60·3 by volume.

Rum.—This liquor is obtained by the fermentation and distillation of the juice of the sugar cane, its molasses, or the refuse from the manufacture of sugar. It is produced especially in France, the East and West Indies, and in the United States. The manufacture of rum is essentially the same as that of other liquors, but special attention must be paid to the temperature of the liquor during fermentation. The addition of yeast is usually unnecessary. In its place the planters of the West Indies employ the lees of former distillations; and to this is attributed the fine aroma of genuine rum. In some cases cinnamon, anise-seed, and the leaves of various trees are added to disguise the nauseous odour of the liquor.

Like all distilled liquors, rum is colourless, as it comes from the still, and whatever colour it acquires is derived from the cask in which it is kept, or is produced by the addition of caramel.

Various forms of fraud are practiced in the manufacture and sale of rum. It is sometimes made of grain spirit, with the addition of flavouring compounds. Water or diluted alcohol are often added by the retail dealer. The flavouring essences, which are added in making artificial liquors, are but trifling in amount, and when skilfully used, cannot be distinguished by chemical tests from the natural bouquets.

Twenty-five samples of rum were examined by Dr. Engelhardt. The alcohol varied from 26·1 to 47·8 per cent. by volume. No injurious foreign substances were detected.

GROUPS IX. AND X.

IX.—CRUDE Vegetable and Animal Drugs.

X.—PHARMACEUTICAL Chemicals and their Preparations.

Report by F. Hoffmann, Ph.D., of New York.

Drugs and chemicals are liable to become impaired by accidental or intentional substitution of inferior materials, by contamination resulting from want of knowledge and care in gathering and preparing drugs. An article originally good may have its value diminished or destroyed by deterioration through moisture, exposure, and age.

In examining crude and powdered drugs, Dr. Hoffmann relied on their chemical characteristics, and their structure, and also on chemical tests in some cases. The "most approved methods" were employed in the examination of chemicals. No methods of procedure are given in detail, reference being made to the "National" and the "United States" Dispensatories, Pharmacopœia and the "Examination of Medical Chemicals" by F. Hoffmann.

"As absolute purity in most medicinal chemicals and their pharmaceutical preparations is neither necessary, nor in many of them readily attainable, a certain margin has to be admitted and the due allowance to be made" for insignificant and different admixtures incident to their preparation. The skill and experience of the analyst must be relied upon to draw the "proper line between the legitimate limit and the undue excess of any such impurity." "Their nature and character, moreover, have to be taken into special consideration whenever the impurity, or its amount and nature in any way may be objectionable, either by their powerful properties, or by their lessening or modifying the therapeutical value and effect of the chemical."

"For all such chemical and pharmaceutical preparations which admit and require, and for which the Pharmacopœia has established the standard of strength on the basis of a specific or otherwise well-known and chemical assay, this test has in general to be applied as the principal criterion."

In a foot-note Dr. Hoffmann mentioned the system of inspection carried out in Germany with regard to the pharmacies and dispensing establishments. The Board of Inspection consists of the department councillor of the provincial government, the district physician, and an apothecary. All the supplies of drugs and pharmaceutical preparations are examined, the assistants are questioned, the books looked into, and indeed, it appears to be a thorough inspection of everything and everybody about the establishment.

Dr. Hoffmann then proceeds to give the results of his examinations of samples submitted to him.

CRUDE VEGETABLE DRUGS.

Twenty-three specimens of *Seneca root* were examined, of which eighteen were of good quality, the balance being composed wholly or in part of "inert rootlets," and roots of inferior quality.

Virginia snake root, twenty-one specimens examined, all of fair quality except one, which was the rhizome and rootlets of *Asarum canadense*.

Sarsaparilla root, twenty-three specimens examined, of which number nine were of good quality. Six consisted of false sarsaparilla (*Aralia nudicaulis*), two were of poor quality, and four consisted largely or entirely of foreign matter.

Foxglove leaves.—Of twenty-two samples of *foxglove leaves*, ten were found deteriorated by age and exposure.

Saffron.—Twenty specimens of *Spanish saffron* were next examined, sixteen of which proved to be florets of safflower, or bastard saffron, three were true saffron, and one which was true saffron had been completely exhausted.

Myrrh.—Twenty-one samples of *myrrh* were found of good quality, excepting four, which were inferior.

White wax.—Seventeen samples. Eleven were pure wax, three contained paraffin, and three contained stearin. For detecting the stearin 5 grains of the wax were dissolved in chloroform and agitated with lime water. The presence of paraffin was ascertained by treating the wax with benzine and evaporating the fluid to dryness. The residue, if any, is paraffin with a little wax, the latter being then destroyed by concentrated sulphuric acid.

Oil of Cacao.—Nineteen specimens examined. Thirteen were sufficiently pure, while six contained tallow. Bjorklund's test was employed, the material being dissolved in ether and then placed in ice water, by which the oil of cacao separates in granules, the ether remaining more or less turbid in accordance with the amount of foreign fats present.

Quince seed.—Thirteen samples. One was of poor quality and six were adulterated with foreign substances.

Lycopodium.—Fifteen specimens and all of good quality.

Lupulin.—Eighteen specimens. Eleven were of good quality, the rest being inferior or worthless.

Arrowroot.—Twenty specimens. Twelve were genuine Maranta arrowroot, and the others were adulterated with potato, corn, or wheat starches.

POWDERED DRUGS.

"The estimation of the quality and purity of most powdered vegetable drugs offers greater difficulties, since the methods for the detection of inferiorities and adulteration are less definite and established than is the case with unpowdered drugs, and since their adulteration consists not only in the admixture of cheaper foreign material, mostly starches, flour, or cellulose, but also and now pre-eminently in the admixture of inferior brands of the same drug. The microscopical method of examination has largely been made unavailing in recent years by shrewdly dispensing with the use of flour or starches as adulterants, once much practised." Pharmaceutical and chemical tests are not applicable except in certain cases where the value of the drug depends upon some constituent which can be readily determined, as in opium and cinchona bark. These tests are of questionable value in the case of such drugs as ipecac., whose percentage amount of pure emetia is both too small and too variable to furnish a constant and reliable criterion ; or in jalap or other drugs containing resins or gum resins, whose amount of soluble resin can readily be maintained by substitution in case of fraudulent exhaustion or adulteration. Empirical and comparative tests have therefore more or less to be resorted to for obtaining an approximately correct and reliable estimate of the quality of the powdered drugs ; and these tests must be based and conducted on a thorough knowledge of the physical characteristics of each drng, and on a sufficient amount of skill, experience, and unbiased judgment of the expert.

Ipecac. root.—Twenty-two specimens examined. Ten contained "small admixtures of flour or starch other than that of ipecac."

Jalap root.—Twenty-two specimens. Most of them were more or less wanting in the strength of the characteristic odour and taste of best jalap, and eight contained foreign starches.

Orris root.—Nineteen specimens. "Ten specimens were of good quality," four contained corn starch, "six contained evidently an admixture of some flour."

Rhubarb root.—Twenty.three specimens. All were of good appearance, some of unusual bright yellow colour, six contained foreign starches.

Mustard seed.—Twenty-four samples. Ten were pure mustard, twelve contain admixtures of more or less flour.

MEDICINAL CHEMICALS.

The following is a list of the medicinal chemicals examined :

Benzoic acid	.. 17	No Adulteration.
Citric acid	.. 14	" "
Tannic acid	.. 18	" "
Gallic acid	.. 3	" "
Subcarbonate of Bismuth	.. 12	" "
Subnitrate of Bismuth	.. 18	" "
Oxalate of cerium ..	.. 14	" "

Codeia	.. 7	One specimen consisted of sulphate of morphia.
Iodine	.. 20	No Adulteration.
Iodoform	.. 16	,, ,,
Iodide of ammonium..	.. 11	,, ,,
Iodide of sodium ..	.. 3	,, ,,
Iodide of potassium ..	.. 17	Two specimens were the bromide of potassium and one contained a small quantity of this salt.
Cream of Tartar ..	.. 15	No Adulteration.
Saltpetre	.. 15	Three contained considerable chlorides.
Tartar emetic	.. 15	No Adulteration.
Reduced iron	.. 7	Two were deteriorated by age and exposure.
Carbonate of iron ..	.. 8	No Adulteration.
Nitrate of silver ..	.. 15	,, ,,
Oxide of zinc.. ..	.. 14	,, ,,
Sulpho-carbolate of zinc	.. 6	One was the sulphate of zinc.
Santonin	.. 15	No Adulteration.
Sulphate of morphia ..	.. 16	,, ,,
Muriate of quinia ..	.. 2	,, ,,
Sulphate of quinia ..	.. 19	Two specimens were composed entirely of sulphate of cinchonidia, one contained an undue amount of this salt besides an admixture of the lower cinchona alkaloids. The other specimens are of sufficiently good quality. They lose from 11 to 16 per cent. by drying at a temperature not exceeding 120° F.; and all show by the pharmacopœial ether test a slight reaction for the lower cinchona alkaloids.

"In consideration of the fact that there are in the State of New York, according to reliable statistics, approximately not less than 2,800 drug stores, and besides about 3,000 country and variety stores where among all sorts of merchandise, drugs and ready-made medicines are also vended, the number of specimens (659) obtained for the present examination represents a comparatively insignificant figure, altogether inadequate to serve for forming a correct inference or an average estimate of the quality and general character of drugs and medicines dispensed at present throughout our State." From the examination made, medicinal chemicals are considered of "fair quality," less so in the case of crude drugs. Powdered drugs "are to a great extent of unsatisfactory quality and questionable reliability."

In regard to patent medicines, Dr. Hoffmann says, they are increasing in number and are of much importance as articles of commerce. The trade list of secret and proprietary medicines embraces at present a much larger number of articles than all the legitimate preparations of the Pharmacopœia."

"These medicines are vended everywhere in our State and country, under no restriction or control whatever."

"Much has been written about the exteneive and indiscriminate and frequently reckless use and misuse and the consequent injury and dangers of this kind of medication by medicines and preparations of unknown composition and qualities. A number of them have from time to time been analyzed, and some have been found to contain potent drugs, the dispensation of which in such doses would hardly be risked or approved in the practice of legitimate medication, while the nostrum-makers dispense them with the additional medical advice, unrestricted."

Group XI.

Gelatin, and sugar-coated and Compressed Pills of Quinine.

Report by Prof. G. C. Caldwell, Ph.D., of Ithaca, N. Y.

QUININE IN PILLS AND CAPSULES.

"The literature of this subject is very scanty indeed, and it does not appear that the large quinine-consuming public of this country has any assurance whatever that it gets its two, three or five grains of sulphate of quinine in the pills, capsules and other preparations said to contain these quantities."

Prof. Caldwell's work in this division was confined to the determination of the amount of quinine sulphate in the samples received, without attempting to ascertain the extent to which other alkaloids of the bark are substituted for it to make up the deficiency where it exists. Twenty-nine samples of quinine pills were examined, and it appears that in every case the amount of quinine sulphate was below that which it was professed the pill contained. Two-grain pills were found to contain from 0·9 to 1·8 grains of the sulphate; the three-grain pills contained from 1·7 to 2·8 grains, while the five-grain pills contained from 2·4 to 4·7 grains.

To be continued.

SOCIETY OF PUBLIC ANALYSTS.

The Country Meeting of this Society will be held at Birmingham on the 20th inst. The usual particulars will be sent to Members.

THE ANALYST, VOLS. I., II., and III.

The Publishers would be obliged by the return of copies of the above, for which the full published price will be given.

MILK ADULTERATION IN FRANCE.

M. Girard, Director of the Paris Municipal Laboratory, has forwarded a letter to the Society of Public Medicine (*Médécine Publique*), concerning the system adopted by cow-feeders (*nourrisseurs*) in order to produce an excessive production of milk. This Society has appointed a commission to investigate milk adulteration: its members are MM. Barier, Baron, Budin, du Mesnil, Dupré, Fauvel, Girard, Pabst, Porak, Railliet, Trasbot, Emile Trélat and Vallin. M. Girard's letter draws special attention to the fact, that the cowkeepers reject the simple method of adding water to the milk supplied to customers, this fraud being too easily detected. Therefore a special regimen, which is inexpensive, and certain to result in excessive lactation, is adopted, such as malt and the *debris* of oil factories. The cows fed on this diet give a milk which is thin, non-nutritive, and watery, though excessive in quantity. The animals, after a short space of time become phthisical and die, their proprietors having, however, realised large profits on a small outlay.—*Sanitary Record.*

THE MILK OF PARIS.

Paris authorities for some time suspected that the milk of that metropolis was watered. Then they decided to stop it, but first to assure themselves that it was watered. The milk cans are all unloaded in a large warehouse at the side of the Batignolles Station, and twenty-five policemen were posted outside, loop-holes having been made in the wall to enable them to watch the movements of the milkmen. Just when they had brought in the water, and were beginning to make their customary mixture, the police rushed in and caught them. They were at first inclined to resist, but the presence of the commissary with his tricolor scarf seems to have overawed them, and they allowed him to make a very important capture. They were also found to have a large quantity of bi-carbonate of lime, together with a contrivance for removing the sealed covers which some of the milk cans have, and for putting them on again after the contents have been adulterated.—*Sanitary Engineer.*

LAW REPORTS.

Butter or Butterine:—

At Tunstall Police Court, lately, Mr. John Plant, shopkeeper, Wolstanton, was charged with selling adulterated butter. The certificate of the County Analyst stated that the sample contained only 4·6 per cent. of real butter-fat. Defendant's wife, after the purchase had been made, and its purpose mentioned, said she did not sell it as butter, but as butterine. Mr. Ackrill, on behalf of the defendant, said the butter was purchased from a wholesale grocer as genuine butter. He produced an invoice which described the article as butter, and he contended that this was a written warranty. Major Knight, the county inspector, disputed this description of the invoice. Mr. Randall (of the firm of Harrison and Randall, wholesale grocers) said he took the order for the butter of the defendant's wife, and in due course handed it in; but butterine must have been sent by mistake. The price charged was the price of pure butter of second quality. Mr. Ackrill pressed his view that the invoice constituted a written warranty; and, after some discussion, the Bench adopted that view, and dismissed the charge.

Coffee Adulteration.

Mr. James Morris, shopkeeper, Butt Lane, was charged with selling coffee adulterated with 60 per cent. of chicory. Defendant said he sold the coffee as he bought it, and he did not know it was not genuine. He had bought a pound in February last, and he had not sold the whole of it yet. In this case a fine of 2s 6d. and costs (22s. 6d.) was imposed.

Ann Beech, Alsager's Bank, was charged with selling coffee adulterated with 70 per cent. of chicory. This defendant also pleaded that she sold the coffee as she bought it. She was ordered to pay 5s. and costs, in all £1 7s. 6d.

In the Glasgow Sheriff Court, before Sheriff Guthrie, Mr. James Anderson, grocer, 604A, Gallowgate was charged, at the instance of the Sanitary Department, with having sold a quarter of a pound of coffee, certified by the Public Analyst to contain 15 per cent. of chicory. The defendant pleaded guilty, and after hearing agents on both sides, the Sheriff imposed the penalty of 30s.

At Liverpool Police Court, Mr. John Tyson, grocer, 30, Copperashill, was fined 20s. and costs for selling, as pure, coffee to which upwards of twenty parts of chicory had been added; and Jarratt Roberts, grocer, 1, Fairclough Lane, was fined 20s. and costs for selling, as pure, rock-cocoa to which 35 per cent. of sugar had been added.

Pepper and Dirt :—

At Clerkenwell Police-court, on September 15, Mr. William Tozer, grocer, 103, Central Street, St. Luke's, was summoned for selling pepper which had been adulterated with 4¾ per cent. of earthy matter. The defendant said he sold the pepper in the same condition as he purchased it; it was difficult to avoid a little dust getting into the pepper, however much care was taken. Mr. Barlow said he hardly knew what to do in the matter, but the percentage of adulteration was so small that he thought he would dismiss the summons.

RECENT CHEMICAL PATENTS.

The following specifications have been recently published, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

No 1881	Name of Patentee.	Title of Patent.	Price
5400	T. Rowan	Electric Light Lamps or Lanterns	2d.
5477	W. R. Lake	Electric Lamps	6d.
5632	J. S. Sellon	Incandescent Lamps	2d.
1882			
130	W. T. Henley	Machinery for obtaining Electric Currents	1/6
203	G. Payne	Distillation of Glycerine	6d.
231	C. W. Siemens	Telephonic Conductors	6d.
234	W. R. Lake	Dynamo Electric Machines	6d.
252	H. H. Lake	Electrical Accumulators	6d.
289	J. Humphrys	Secondary Batteries	4d.
290	H. J. Haddan	Telephone Conductors	2d.
299	S. Pitt	Utilization of Phosphatic Metallic Slags	4d.
305	J. N. Aronson	Electric Lamps	6d.
311	Hy. D. Scott	Treating Phosphatic and Nitrogenous Substances for Manure	4d.
316	E. G. Brewer	Telephone Transmitters	6d.
339	E. de Pass	Regulating Electric Lamps	6d.
346	R. E. Crompton	Electric Lamps	8d.
354	H. J. Haddan	Manufacture of Acetic Acid	2d.
359	J. N. Aronson	Electric Lamps	8d.
367	W. Windus	Manufacture of Sulphuric Acid	2d.
377	Sir C. Bright	Electric Lamps	6d.
392	W. P. Thompson	Obtaining Light by Electricity	6d.
398	C. Scheibler	Manufacture of Sugar	4d.
440	G. Neilson	Abstracting Ammonia from Gaseous Products of Combustion in Furnaces	6d.
433	L. Mond	Manufacture of Cyanogen Compounds and Ammonia	6d.
441	C. F. Varley & W. Judd	Electric Railways	4d.
473	J. Brock	Utilizing Alkali Waste	2d.

No. 1882	Name of Patentee.	Title of Patent.	Price
489	G. Skrivanoff	Electrical Batteries	6d.
509	G. S. Hazlehurst	Manufacture of Salt Cake and Muriating Acids	6d.
513	C. V. Boys	Electric Meters	6d.
538	W. R. Lake	Electrical Accumulators	6d.
540	J. D. Andrews	Dynamo Electric and Electro Dynamic Machines	6d.
541	T. Morgan	Electric or Magnetic Motor	6d.
543	P. Thomas	Bleaching Fibrous Matter without employing Chlorine	4d.
554	F. Springmuhl	Apparatus for Concentrating Milk	4d.
555	F. Springmuhl	Manufacture of Condensed Grape Juice or Must	4d.
563	A. J. Jarman	Arc Electric Lamps	6d.
578	B. J. Mills	Electric Lamps	6d.
607	R. & M. Theiler	Telephone Transmitters	2d.
620	G. Scott	Manufacture of Triple Alloys of Manganese	6d.
621	J. B. Rogers	Effecting and Maintaining Continuity of Divided Electric Currents	6d.
626	A. A. Common	Electric Lamps	6d.
633	A. Riegelman	Anti-corrosive Paint	4d.
661	H. H. Eldred	Telephone Exchange Systems and Apparatus	8d.
667	H. J. Haddan	Purifying and Discolouring Saccharine Liquids	2d.
669	P. Class	Distillation and Purification of Alcohol	6d.
676	C. Scheibler	Manufacture of Sugar	4d.
686	A. M. Clark	Telephone Call or Signalling Apparatus	6d.
688	A. M. Clark	Transmitting and Repeating Sounds by Electricity	8d.
731	E. V. Gardner	Manufacture of White Lead	1/0
732	W. Gentles	Manufacture of Sulphate of Alumina	2d.
740	A. M. Clark	Electric Lamps	6d.
760	C. W. Siemens	Dynamo Electric or Electro Dynamic Machine	6d.
761	C. J. Chubb	Dynamo Electric and Magneto Electric Machines	2d.
777	C. D. Abel	Recovering Tin contained in Waste Metals	4d.
798	H. C. Stormer	Recovering Soda used in making Wood Pulp Stuff	6d.
831	J. Rapieff	Electric Lamps	6d.
837	I. L. Pulvermacher	Apparatus for Collecting and Storing Electric Currents	2d.
869	C. E. Spagnoletti	Dynamo Electric Machines	6d.
898	J. Brockie	Electric Arc Lamps	8d.
905	J. W. Swan	Secondary Batteries	4d.
921	J. Dempster	Manufacture of Sulphate of Ammonia	6d.
960	J. A. Dixon	Production of Certain Derivatives of Metaoxybenzaldehyde	4d.
2278	H. H. Lake	Manufacture of Oxide of Lead	4d.
2416	H. H. Lake	Electric Batteries	6d.
2526	W. R. Lake	Dynamo or Magneto Electric Machines	6d.
2563	W. R. Lake	Electric Lamps or Lighting Apparatus	6d.
2570	W. R. Lake	Electric Lamps	6d.
2632	W. R. Lake	Electric Lamps	6d.
2744	J. Imray	Dynamo Electric Machines and Electric Motors	6d.

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; Journal of Applied Science; The Provisioner; The Practitioner; New Remedies; Proceedings of the American Chemical Society; Le Practicien; The Inventors' Record; New York Public Health; The Scientific American; Society of Arts Journal; Sanitary Engineer of New York; The Chemists' Journal; Weekly Drug News; Sugar Cane; Country Brewers' Gazette; The Medical Record; The Canada Lancet; Gas and Water Engineering; The Grocers' Gazette; Columbia School of Mines Quarterly Magazine; London Water Supply, by Crookes, Odling and Tidy; Chemical Review; Report on Operations of Glasgow Sanitary Department; Analysis of Accounts of Metropolitan Water Companies, by A. Lass; Chemistry, Inorganic and Organic, by T. W. Drinkwater.

THE ANALYST.

NOVEMBER, 1882.

SOCIETY OF PUBLIC ANALYSTS.

THE next GENERAL MEETING of this Society will be held at Burlington House, Piccadilly, on Wednesday, the 15th November, at 8 o'clock.

THE DETERMINATION OF ORGANIC MATTER IN POTABLE WATER.

IN reference to the Instructions for Water Analysis published in THE ANALYST last year, we print the following abstract (from the *Weekly Drug News*) of a preliminary report by Professor J. W. Mallett, F.R.S., University of Virginia, U.S.A., on the results of an investigation made by direction of the New York National Board of Health as to chemical methods in use:—

Examination of Water Samples in general.

1. Great care should be taken that water samples be placed in the hands of the analyst, and their examination begun with the least possible delay after they have been collected. The changes which take place, sometimes rapidly, on keeping, may seriously affect the results, especially in the case of waters much polluted by foul organic matter.

2. It is very desirable that, besides examining a water in its perfectly fresh condition, samples of it should be set aside, in half filled but close glass stoppered bottles, for some time—say 10 or 12 days—and one of these examined every day or two, so as to trace the character and extent of the changes undergone. Not only may conclusions be drawn from such a series of observations as to the general stability or decomposability of the organic matter present, but light will be thrown upon the changes which may be expected to occur under ordinary conditions when the water is stored for use, as in cisterns, wells during periods of drought, or carelessly allowed to remain stagnant in pitchers, water coolers, &c.

Combustion Process.

1. In applying this process, no matter how skilled or well trained the analyst may be, duplicate or even triplicate concordant results should be insisted upon before accepting the determinations as trustworthy.

2. In order to avoid the presence in the atmosphere, about the water bath used for the evaporation, of ammonia derived from coal gas, the bath should be heated by steam brought in a small, closed pipe from a distant boiler, preferably situated in another room, and the waste steam and condensed water therefrom should be in like manner carried off to a safe distance.

Albumenoid-Ammonia Process.

1. In order to avoid the uncertain ending of the collection of ammonia, whether "free" or "albumenoid," it would be well to adopt the rule that the distillation be stopped when, and not before, the last measure of distillate collected contains less than a certain

proportion—say one per cent.—of the whole quantity of ammonia already collected. This would in many cases involve the necessity of replenishing the liquid contents of the retort with ammonia-free water.

2. In order to diminish the loss of amines or other volatile forms of nitrogenous matter, a separate distillation should be made with alkaline permanganate added at once, in addition to the usual course of treatment prescribed by Wanklyn—distillation begun with sodium carbonate, and continued after addition of the alkaline permanganate. The results of the two separate distillations should then be compared.

3. In reporting the results obtained by the albumenoid-ammonia process, including the determination of free ammonia, the details of the evolution of ammonia, as collected by separate measures of distillate, should always be given.

Permanganate Process.

1. In view of the evidence obtained rendering probable the loss of organic matter by volatilization in the use of acidified permanganate at a boiling temperature, the Tidy form of the process is rather to be recommended than that of Kubel if but one be used.

2. On the other hand, the advantage of more extended oxidizing action, and the greater general accordance of the results by the Kubel process with those for organic carbon by the combustion process, make it desirable that as far as possible the same advantages should be secured by substituting the influence of time for that of temperature, and that the time during which the permanganate is allowed to act in the Tidy process should be increased to at least 12, better to 24, hours, several determinations (on different samples set aside at the same time) being made at such intermediate intervals as 1, 3, 6, 9, and 12 hours, in order to trace the progress of the oxidation.

SUGGESTIONS AS TO POSSIBLE IMPROVEMENTS ON THE PROCESSES EXAMINED DESERVING FURTHER INVESTIGATION.

Combustion Process.

1. I would propose to evaporate the water, not under ordinary pressure and in contact with the atmosphere, as usual, but as the specimens of water were evaporated for the biological experiments, in a closed vessel immersed in a water bath and connected with a good (water jet) air pump, so as to secure a nearly complete removal of air, with a condensing worm to dispose in part of the aqueous vapour given off. It would not do to simply place the water in a flask, since the residue could not be removed for combustion, but it would not be difficult to arrange a suitable vacuum vessel, with wide mouth and tightly clamped on cover, within which might be placed the usual glass dish to receive the water, and the feed might be managed through a nearly capillary tube with a glass stopcock. By such an arrangement the evaporation might be effected within a moderate time at a fixed temperature much lower than the boiling point, thus probably reducing any loss from simple volatilization of organic matter; the nearly complete exclusion of air would tend to greatly diminish or do away with loss of organic matter by oxidation, and permit of large reduction in the quantity of sulphurous acid used; for the same reason the tendency to formation of sulphuric acid would be reduced to a minimum, and the absorption of ammonia from the atmosphere about the dish would be altogether prevented. In testing this last named effect, two bulb tubes containing pure sulphuric acid might be interposed between the vacuum chamber and the pump; the contents of the one to be tested for ammonia given off

from the water, those of the other to guard against any trace of ammonia coming back from the outside air during irregular action of the stream of water.

2. In order to avoid loss during the evaporation of readily volatile substances, such as butyric, valerianic, &c., acids, to dispense with the necessity for the uncertain and unsatisfactory correction for ammonia lost by dissociation, to get rid of the influence on the determination of organic nitrogen of any errors in the determination of the total ammonia, and to avoid corresponding difficulties arising from the presence of nitrates if these be allowed to remain, it might be well to evaporate at first with the addition of a small excess of magnesia (as recommended by Lechartier), thus removing all ammonia, and then, the water having been brought down to a small volume, add a moderate excess only of sulphurous acid* with a drop of a solution of a ferrous salt (as directed by Frankland), and complete the evaporation to dryness—the whole process to be carried out in a jet pump vacuum, as above suggested.

3. Further experiments are desirable in order to completely determine the merits and defects of the Williams' ("copper-zinc couple") method for the removal of nitrates.

4. Some preliminary experiments of my own seemed to show that nitrates and nitrites may be completely reduced by evaporating to a small bulk with no great excess of phosphorous or hypo-phosphorous acid, guarding against the evolution of phosphoretted hydrogen by the low temperature employed, then adding magnesia in small excess and completing the evaporation, thus leaving the residue in a pulverulent instead of a sticky condition, easy of removal from the dish, and probably allowing of complete combustion without inconvenience from the final oxidation of the small excess of phosphite or hypophosphite, and without any wrapping up of carbon particles. This plan deserves to be carefully tested.

Albumenoid-Ammonia Process, including Determination of Free Ammonia.

1. In order to prevent, or at least to largely reduce and render uniform, the loss of ammonia from imperfect condensation, I would prefer to effect the distillation, not by a lamp flame, but in a retort of uniformly determined shape and size, uniformly immersed in a bath of saline solution or other suitable material kept at a uniform temperature—say 102° or 105° C.—by means of steam, and to condense in a glass worm, surrounded by ice-water, sufficiently long to bring the distillate to a uniform temperature, not exceeding say 5° C.

2. It would be perhaps still better to conduct the distillation in a completely closed apparatus, with a fixed difference of temperature between the retort and the far end of the fully effective condensing tube, with a glass stopcock to draw off the distillate in successive measured portions, and a little safety valve (mercury or other) near the cold end to prevent any dangerous difference of external and internal pressure.

3. In the determination of free ammonia, with a view to distinguishing as sharply as possible between ammonia really existing as such or in ammoniacal salts and that found by breaking up of organic matter, it might be well to try a closed distilling apparatus connected with a (water jet) air-pump, so as to maintain a partial vacuum within, keeping the retort at a fixed temperature much below 100° C. and collecting the whole of the ammonia in a flask and one or more bulb tubes containing rather weak mineral acid, interposed between the condenser and the pump. This would, however, be attended with the disadvantage of

* I doubt, however, the possibility of fully reducing nitrates, by means of sulphurous acid, if they are present in large quantity.

not readily permitting the progress of the evolution of ammonia to be traced by its collection in separate successive measures of distillate; and it would become necessary to ascertain whether the application of the Nessler test would be in any way interfered with by the sodium salts formed from the acid used to collect the ammonia.

4. In order to overcome, if possible, the most serious difficulty in the way of a correct determination of free ammonia, namely, the ready breaking up of urea (and other amides), when present, on heating with sodium carbonate, it would be well to ascertain at how low a temperature and within what time, if at all, ammonia really existing in ammoniacal salts could be completely driven off from an extremely dilute solution by adding a small excess of magnesia and maintaining a (water jet) air-pump vacuum above the liquid, forming a stratum of small depth, with bulb tubes of acid between the liquid and the pump to intercept the ammonia, and guard tubes to prevent any being received from the air; in other words, to ascertain whether Schlœsings's method for the determination of ammonia admits of being applied to such excessively minute amounts of it as the water analyst is concerned with.

5. In the conduct of the albumenoid-ammonia process proper, *i.e.*, the distillation with alkaline permanganate, I would propose that the original volume of liquid in the retort be maintained constant, by running in at the proper rate, through a nearly capillary tube with a glass stopcock, ammonia-free distilled water. And, in cases in which the amount of organic matter is so large as to wholly, or in great part, reduce the usual charge of alkaline permanganate, I would determine by a preliminary experiment at about what rate the reagent is used up, and would then progressively supply its solution, instead of simply pure water, at such a rate as to keep the original strength as nearly as possible unaltered.

Permanganate Process.

1. The principle involved in the last paragraph applies also to this process. Instead of using a fixed amount of permanganate at first, and adding a second or third charge only when the former has been completely reduced, there ought to be a fixed excess at the end of the action, or rather there should be present a constant excess all through the process. Hence, when a preliminary experiment has shown that more than the usual charge of permanganate will be needed, and about the rate at which it will be consumed, for the final experiment additional permanganate solution should be gradually dripped in, from a nearly capillary tube, at such a rate as to maintain the original excess as nearly as possible constant.

2. It is desirable that the process be carried on at a pretty nearly fixed temperature. If the Tidy method be followed, a temperature of say 20° C., could, with a little management, generally be secured, and the flasks kept approximately at this point during the time required for the action.

CRESOTE—ITS TESTS AND ACTION.*

BY H. HAGER.

I HAVE previously written on the curative value of creosote and the preparation of creosote pills. Now that we are able to procure and dispense genuine creosote from beechwood tar, I take the liberty of again treating the subject from a therapeutical and chemical point of view.

* Translated for *The Weekly Drug News* from *Deutsch Amerikanische Apotheker Zeitung*.

Camboulives, a French physician, warns us in his *Manuel Pratique de la Therapeutique* to distinguish well between creosote and phenol (carbolic acid), as the former from beech-wood tar was destined to play a great part in therapeutics owing to its powerful action. More than this; it coagulates albumen, has the property of preserving animal substances for a long time, and being antiseptic, anatomical preparations can be kept in a lasting state of preservation.

But creosote has other virtues, owing to its causticity and astringent power. When put in contact with the skin it produces wounds that are similar to burns and pain like them. On account of its corrosive power it is much used to kill the tooth nerve in toothache. When diluted it is no longer caustic, but becomes astringent. Taken inwardly in moderate doses it develops a feeling of warmth in the stomach with sour eructations, &c. When it has passed into the blood circulation it tightens the capillaries, and decreases the mucous flow both in the bladder and the air passages.

Camboulives remarks further: "This medicament has enjoyed an undeserved reputation since its discovery, for people were soon convinced that it was only useful for carious teeth and toothache." Nevertheless, Bouchard and Gimbert endeavoured to restore its reputation as a curative agent, and they administered it in pulmonary consumption, &c. Their experiments were successful, and they have published a long list of their observations, to the effect that creosote after being administered for a week or two has the effect of decreasing the expectoration, lessening the cough, increasing the appetite, removing the fever, increasing the strength, and almost suppressing night sweats, while it gives an *embonpoint* such as the patient had only in his healthy days. The abnormal noise heard in the breast of the consumptive ceases and is replaced by a healthy respiration, or at least is smoother in sound owing to the cicatrization of the diseased pulmonary tissue. The improvement in condition may continue for months, provided that the cure is not interrupted too soon. These physicians observed that the symptoms of the disease recur as soon as the use of the creosote is neglected, in the opinion that the lungs are healed.

From these statements it will be seen that Camboulives and many others did not believe in this beneficent action of creosote. They used it without obtaining the desired results. But creosote is a medicament that comes into the market of various degrees of quality, and if the apothecary does not dispense the genuine beechwood tar creosote—*Kreosotum faginum*—the expected results cannot be had.

To ascertain how justified was this unequalled action of creosote, I made use of it in several cases, and I found that consumptives, and sufferers from chronic catarrh visibly improved, and in one instance its use had to be stopped because the *embonpoint* of the patient who had lost flesh considerably, had so increased that new and large clothes had to be obtained. The results obtained by Bouchard and Gimbert have been fully confirmed by my experience, but, of course, only where genuine creosote is employed.

Among the curative qualities of creosote must also be reckoned its anti-asthmatic action. A railway employé who suffered from *asthma spasticum* and who derived some relief from the usual remedies without getting rid of the attacks, had only two attacks after taking the creosote pills. These, however, were mild, and they then ceased altogether. As a precautionary measure, however, he continues, to take the pills every other day.

As creosote made from beech tar is one of the grandest remedies for keeping up

consumptives and those suffering from bronchial diseases, for increasing the flesh of the emaciated, removing asthma, and perhaps bringing tuberculosis to a standstill in its early stages, as well as relieving kidney diseases and destroying the vitality of intestinal worms, it is the incumbent duty of the apothecary to dispense only the genuine and to convince himself of its quality. We shall explain the marks of genuine creosote and the sources from which it can be had.

In a case before me are phenols and creosotes, as follows:

1. Colourless Kreosotum.
2. Colourless Kreosotum album verum.
3. Yellow Kreosotum Anglicum.
4. Brownish Yellow Kreosotum Faginum.
5. Chemically pure Ph. G. Kreosotum from beechwood tar (Kreosot Hannoveranum) yellowish.
6. Kreosotum Saginum (A) yellow.
7. ,, ,, (B) yellow.
8. ,, ,, (C) brown.

Out of these eight kinds only Nos. 4 and 5 proved to be genuine; No. 8 was genuine but very dirty.

1. Pure creosote made from beechwood tar is insoluble in double its volume of anhydrous glycerine, while other creosotes are completely soluble, or give a perfectly limpid mixture. When the mixture is milky or whitish with double the volume of anhydrous glycerine, the creosote is presumably pure, but if coloured (No. 8 was of a muddy red) then the creosote is not genuine.

Phenol is not an adulterating agent in every case; there are others which are not soluble in glycerine, and least of all in a solution of 75 per cent. of glycerine (as for instance creosol or creosylalcohol).

Nos. 1, 2, 3, 6 and 7, when mixed with a double volume of anhydrous glycerine gave clear liquids. Mixtures of $\frac{1}{4}$ to $\frac{1}{3}$ of creosote and $\frac{3}{4}$ to $\frac{2}{3}$ of phenol with glycerine under the same conditions give clear liquids.

2. To observe the action of the phenol, we mix three volumes of glycerine (75 per cent.) with one volume of the suspected creosote and shake well. Two layers will be formed when the mixture settles; one will be very muddy; the other somewhat less so.

The volume by which the last layer has been decreased is approximately that of the phenol present; in order to ascertain it definitely we must increase the layer of the 75 per cent. glycerine by an equal quantity of the same glycerine and shake the whole well. The phenol passes into the glycerine up to 98 per cent.; or we can shake up the creosote with 5 per cent. of caustic ammonia, which dissolves phenol but not creosote from beech tar.

Graetzel and the writer both observed that creosote when agitated with glycerine almost doubled its volume. But, with an undoubtedly genuine specimen before us, we cannot obtain this increase of volume, and this change cannot therefore be regarded as an indispensable mark of beech tar creosote.

These two tests (1 and 2) with anhydrous and 75 per cent. glycerine indicate whether we have genuine creosote, but two reactions are yet required to fully prove it. 3. Equal volumes of creosote and soda lye (of 1·334 specific gravity) are mixed together to ascertain

the wood tar particles. With a very slight degree of heat development there is a clear yellow solution. If the mixture is not clear and transparent, or has another colour, or when it stiffens to a non-liquid mass, the creosote is not pure, if it be present at all. No. 1 gave a muddy whitish, and No. 8 a grayish brown mixture, which thickened after the lapse of half an hour. The remaining non-creosote specimens gave light lemon, dark lemon, or brownish yellow mixtures. No. 4 gave a red mixture, and contained 9 per cent. of non-creosote matters.

The new German *Pharmacopœia* gives a variation of this lye reaction. The soda lye of 460 specific gravity and creosote mixed by equal parts of weight should give a clear liquid (it may be yellow), but must not be dark coloured or throw off bad-smelling tar when diluted with water. According to this test, three kinds of non-creosotes, Nos. 1, 2, and 3, genuine creosotes, and only No. 8 gave a dark coloured muddy mixture. Testing with a soda lye of 1·334 specific gravity is therefore to be preferred. 4. Beech tar creosote gives a clear solution in petroleum benzine. A mixture of 1 volume creosote and 2 volumes of benzine is almost colourless or yellowish, but perfectly clear. Neither phenol nor cresol are soluble in benzine, and creosote gives a rather muddy mixture with even 5 per cent. of this phenol, which, after settling an hour, separates into two layers. This benzine solution, when transparent, is divided into three portions. The first is decomposed by an equal volume of caustic ammonia; the second by a lye of caustic soda of 1·160 specific gravity, and both parts are well shaken. No dark colouring, dark brown, or cinnamon should show itself in the course of half an hour. The third portion is (according to Hartmann and Hauers) mixed and shaken up with an equal volume of caustic baryta water. In this case neither blue, violet, nor red colour should appear. It is immaterial in what layer, the aqueous or the oily, the colouration is; they indicate tar components which should not be present.

5. Mix 1 volume of creosote and 2 volumes of a 15 to 18 per cent. caustic ammonia, shake well, and put aside. The genuine clear creosote will, in the course of half an hour, be coloured almost a lemon shade, and an aqueous layer on top will be yellow gray or some pale colour. A dark colour indicates foreign bodies, and if the volume of the creosote has diminished it contains phenol, cresol, or kindred matters that do not belong, however, to creosote. The test can be made with even a 10 per cent. caustic ammonia, but a double volume is then requisite.

6. Equal volumes of collodium and creosote should not form into a jelly, but should rather become a liquid mass after half an hour; in the contrary case more or less phenol is present.

The first three or five tests are sufficient for true creosote, so that the other reactions may be dispensed with.

A creosote that does not comport itself as such should not be used, at least inwardly. Some of the kinds may be admitted for external veterinary use, but must not be classed as genuine.

Doses should be as small as possible, but often repeated. Proper doses for an adult are 0·02 to 0·03 and 0·04 two or three times daily. The maximum single dose is 0·05, and the maximum for a day 0·2. The pilulæ Kreosotatæ contain 0·0167 g. in each pill (Ph. Centralh. 1881). Consumptives in the last stage may take two or three of these pills two or three times a day, according to bodily size, and if they feel tolerably well after some days

use, they should take two or three pills uninterruptedly night and morning, dropping them, perhaps, one or two days a week.

Pure creosote is pale yellowish, exudes oil, and is of 1·06 specific gravity. The gravity should be fixed at 1·050 to 1·080, as the lighter creosotes were either impure or not properly such.

Creosote is best administered in pills. The pilular mass is made by melting together 2 parts of yellow wax and 1 part of creosote, to which other suitable ingredients are added in form of powder, as quinine salts, salicylic acid, bals. solution, rad. gent., &c. Any addition of ether or spirits of wine, to give consistency to the mass, should be avoided, and is not necessary.

A lukewarm mixture of 7·3 creosote and 15·0 cera flava can, however, be mixed with 40·0 or 45·0 of the powder, so as to form a good pilular mass.

REPORTS ON ADULTERATION IN THE STATE OF NEW YORK.

From the *Sanitary Engineer*, New York.

(Concluded from page 186.*)*

Group XII.

Granular effervescent Salts; Fluid Citrate of Magnesia; Seidlitz Powders.

Report by W. G. Tucker, M.D., of Albany, N. Y.

"Under the head of 'Effervescing Medicinal Preparations,' are included a large number of effervescing salts and compounds, many of which, however, are but little known and have but a limited sale. It was therefore deemed best to make an examination first of the two most important officinal preparations belonging to this class, both of them being well known and highly popular remedies which have long been largely sold and commonly employed, namely, the seidlitz powders (Pulveres effervescentes aperientes, U. S. P.) and the solution of citrate of magnesium (Liquor magnesiæ citratis, U. S. P.) The sales of these two preparations in this State probably largely exceed those of all other effervescing preparations (used strictly as medicines) combined."

I. SEIDLITZ POWDERS.

These are officinal, having been introduced into the Pharmacopœia of 1850.

Composition, etc.—"One powder (commonly enclosed in a white paper) contains 35 grains of powdered tartaric acid, and the other commonly wrapped in blue paper) contains an intimate mixture of 40 grains of bi-carbonate of sodium and 120 grains of the double tartrate of sodium and potassium, or 'Rochelle salt.' When the contents of the two papers are separately dissolved in water and the solutions mixed, the chemical reaction which takes place results in the formation of the neutral sodic tartrate and the liberation of carbonic acid gas, which aërates the mixture, while the Rochelle salt is unchanged. The proportions in which these substances are directed to be employed are almost exactly those which insure the complete decomposition of the bi-carbonate, the chief use of which is to render the mixture effervescing, while the Rochelle salt, a gentle purgative, is the chief medicinal ingredient, although the sodic tartrate produced by the decomposition of the bi-carbonate is not entirely inert. It is therefore seen that these proportions should be preserved, and that if they be widely departed from the powders become less valuable, inert or even harmful. Thus if the Rochelle salt be reduced in quantity while the amount of the bi-carbonate is increased, without at the same time increasing the amount of tartaric acid, the medicine as administered consists largely of undecomposed bi-carbonate of sodium, so that instead of furnishing an aërated solution of neutral purgative salts, it consists largely of the alkaline bi-carbonate, possessing no value as a cathartic, and perhaps even operating injuriously."

Chief sophistications.—Since the cost of Rochelle salt varies from 32 to 36 cents per lb., and that of the bi-carbonate of sodium but from 4½ to 7 cents per lb., it is a not unusual practice to diminish the quantity of the former and increase that of the latter ingredient.

Some slight variation from the correct standard there will generally be, since it is exceedingly difficult intimately to mix the two substances so as to render the composition of a batch of the powder perfectly uniform, but this mixture should be accomplished by proper machinery if the powders are made on a large scale, and the proportion of the two ingredients ought not to vary far from the correct ratio of one to three.

Aside from this unwarranteed alteration, powders are frequently sold which fall below the officinal weights. Slight errors will of course occur, because these powders are ordinarily measured and not weighed, but the variation ought not to be large.

Samples examined.—Seventy-two powders were examined, of which 35 were received from New York, and 37 were collected in Albany and vicinity.

1. *Tartaric acid.*—The average weight of the samples received from New York was 42·6 grains, being 7·6 grains above the prescribed weight. The smallest powder weighed 25 grains and the largest 60 grains.

The average weight of the samples obtained in Albany and vicinity was 35 grains—18, however, being under weight. The smallest weighed 18 grains and the largest 56 grains.

The average weight of 71 samples was 38·7 grains.

There seems little reason to doubt that the amount of tartaric acid is often purposely increased for the sake of decomposing the excess of the bi-carbonate employed in the seidlitz mixture.

2. *The seidlitz mixture.*—The average weight of 35 samples obtained from New York was 162·5 grains, or 2·5 grains over weight. The variation was considerable; 14 were under weight, and 21 over weight, the smallest weighing only 90 grains and the largest 206 grains.

Of the 36 samples collected in Albany and vicinity, the average weight was 143·7 grains. The smallest weighed 63 grains and the largest 225 grains. The average weight of 71 samples was 153·1 grains.

Chemical examination.—A qualitative examination was first made of each powder. The contents of the white paper was proved in every instance to be tartaric acid of good or fair quality. Almost all the samples showed, as would naturally be expected, traces of sulphates and varying traces of lead.

The "seidlitz mixture" contained in the blue paper was found in but three instances to be other than a mixture of Rochelle salt and soda. In one of these labelled "siedlitine." sugar was added; a second contained considerable quantity of bi-carbonate of soda, and in the third the soda was omitted entirely, probably through mere carelessness. No make-weight, or any gross adulterant was detected in any of the powders, save as here stated.

Traces of sulphates were found, but nothing indicating the intentional addition of sulphate of soda, as has been frequently asserted.

The quantitative estimation of bi-carbonate of soda in the seidlitz mixtures was effected by determining the carbonic acid gas in about 4 grammes of each powder, "and in case a qualitative examination had shown no other constituent in decided quantity than soda and Rochelle salt, the amount of the latter was determined approximately by subtracting from the weight of the powder taken the weight of the soda calculated. The ratio was then determined by dividing the weight of the Rochelle salt thus obtained by the weight of soda present. Since good articles of commercial bi-carbonite were found to yield from 94·97 per cent. of real hydro-soda carbonate, 5 per cent. was added to the amount of the constituent calculated."

Results.—"Thirty-five samples from New York gave a ratio of soda to Rochelle salt of 1 : 2·49, while 35 from Albany and vicinity gave a ratio of 1 : 2·63, the correct officinal proportion being 1 : 3. The average of 70 samples was 1 : 2·56. Calling a variation in the proportion of Rochelle salt to soda of from 2·8 to 3·2 of the former to 1 of the latter as fairly allowable, we find that in the 70 samples examined, 50 per cent. fell below the ratio of 2·8 : 1, the lowest ratio being 1·05 to 1, or nearly equal parts of each constituent; 31 or 40 per cent. gave a ratio of between 2·8 and 3·2 to 1, and only 4 of over 3·2 to 1, clearly showing that this variation is by no means accidental, but evidently the result of an intentional alteration in the proportions of the ingredients employed."

Conclusions concerning seidlitz powders.—1. Gross adulteration is probably uncommon. 2. The weights of both the acid and the seidlitz mixture showed a great diversity, and in many instances the

powders are without doubt intentionally manufactured of short weight. 3. The ratio in which the constituents were present in the seidlitz mixtures was in at least one-third the samples too low to be accounted for save by intentional decrease fn the amount of Rochelle and increase in the amount of soda. Such a disproportion annuls or materially lessens the efficacy of the powders for the purpose intended.

II. SOLUTION OF CITRATE OF MAGNESIUM.

This also is an officinal preparation, having been introduced into the Pharmacopœia of 1850, and continued in those of '60 and '70, the formula, however, being changed in each instance. The preparation is a highly popular one, and is largely sold, more particularly in cities and large towns.

To be "officinal," it should be prepared by the process prescribed in the Pharmacopœia of 1870, although this, with those which have preceded it, is open to some objections, the chief being that after standing for some time the solution deposits a granular precipitate of magnesia citrate. Probably this difficulty cannot be obviated except by diminishing largely the amount of carbonate of magnesium employed in its manufacture.

Sophistications.—In order to obtain a clear, unalterable, saleable solution, and also to lower the cost of manufacture, an effervescing solution of sodium tartrate made in various ways, sweetened with simple syrup and flavoured with essence of lemon to simulate the real citrate, is frequently sold in its stead and under its name.

Fourteen samples were examined, 9 from New York and 5 from Albany and vicinity. Of the 9 New York samples 6 contained magnesic citrate, potassic citrate (potassic citrate being added in bottling and just before corking, to cause effervescence) and free carbonic acid. These contained no carbonic acid, and may be considered genuine. Three consisted mainly of a solution of sodic tartrate, and contained no magnesia nor citric acid. Of the 5 samples obtained in Albany and vicinity, 2 consisted of a solution of magnesic citrate, &c., and were considered genuine, while three were solutions of sodic tartrate, and contained no magnesia nor citric acid. Of the 14 samples examined 6 were therefore spurious, from which it would appear that the preparation sold under the name of the "solution of citrate of magnesia" is frequently sophisticated.

ON A NEW METHOD OF MAKING A VOLUMETRIC SOLUTION FOR DETERMINING THE HARDNESS OF WATER.*

By C. R. C. Tichborne, F.C.S.

It was remarked that to determine the hardness in waters we have never been able to improve, or modify, to any extent the original process of Dr. Clarke, invented nearly half a century ago. The most important proposals have been made in connection with the making of the soap solution and the standard calcium solution used for titration. Dr. Clarke used a soap made from animal fats (curd soap), and it has been respectively proposed to use a soft soap made from olive oil, lead soap *(emp. plumbi)*, or a soda soap of olive oil (Castile soap). These are undoubtedly better than curd soap, as the fatty acids in the others mainly consist of oleic acid, and the oleates are less prone to separate in cold weather.

Dr. Tichborne now proposes to prepare a definite oleate of soda to replace the somewhat variable soap solution. He points out in this paper that oleic acid forms a monobasic and a dibasic salt. Either answer for the purpose.

The following is the process:—

Five c.c. of oleic acid are measured with a pipette and 50 c.c. spirit added to it in a beaker; 2 drops of phenolphthalein solution are also added, and immediately a volumetric solution of soda is run in until a pink indication is produced. This indicates that the point of neutrality has just been passed. The result is a solution of the monobasic salt A

* Read at the meeting of the British Pharmaceutical Conference.

drop more of the volumetric solution of soda develops the pink to a magenta, but, as the process goes on the solution again becomes decolorised, indicating the formation of the dibasic salt. When half the second equivalent of soda has been added the solution begins to pectise, and when the process is complete the solution becomes a solid jelly. Whichever solution is made (the author prefers the latter, as it lathers more freely and is more permanent), the oleate of soda is then made up to the required measure by the addition of a mixture of equal parts of rectified spirit and distilled water.

The advantages claimed are that the soap solution may be made in five minutes, requires no titration against a standard water, and is more permanent than those made from ordinary soaps.—*Chemist and Druggist.*

PURIFICATION OF SULPHURIC ACID BY CRYSTALLIZATION.

In the *Zeitschrift für Analytische Chemie*, Tjaden Moddermann remarks that he has for some time been accustomed to prepare pure sulphuric acid by recrystallization of the hydrate $H_2SO_4H_2O$, and finds this seldom adopted method of purification to be really an excellent one. The author has experimented in this way upon acids containing considerable quantities of lead and arsenious and nitric acids, &c., and by protracted recrystallization has in all cases obtained a pure acid from them. The method is very simple. The acid is mixed with sufficient water, and, in bottles two-thirds full, exposed to the cold in the open air on a frosty night. If the mixture has been properly made, it is generally frozen throughout the next morning. The chief thing then is to carefully separate the crystals from the mother liquor, and for this purpose the author employs a centrifugal apparatus, so constructed that the acid only comes in contact with glass. The separation is very easily effected, and except in cases where an acid is strongly contaminated with the different oxides of nitrogen, one recrystallization is generally sufficient.

SODA IN COMMERCIAL POTASH.

A Belgian chemist gives the following method for detecting the presence of soda in samples of carbonate of potash. It is based on the fact that chloride of sodium is much less soluble than chloride of potassium in strong hydrochloric acid. A solution of the potash to be tested is prepared, the potash being dissolved in ten times its weight of water. One ounce of this solution is saturated with diluted hydrochloric acid, and then evaporated until it is dry. The residue, which is a fine powder, is introduced in a bottle of 10 oz. of hydrochloric acid of 1·189 specific gravity which has been previously saturated with chloride of sodium, being then added. The mixture is well shaken, then left to settle, and after five or six hours all the chloride of sodium will have settled to the bottom, whilst the chloride of potassium will be in solution. The whole is now filtered through asbestos, and the deposit is washed with hydrochloric acid saturated with chloride of sodium. It is then dried at 150° C., weighed, and will consist entirely of chloride of sodium, an accurate result being obtained if the operation has been carefully executed.—*Weekly Drug News.*

A late analysis of ash from the last eruption of Vesuvius shows it extremely rich in sulphuric acid, phosphoric acid, soda, potash, lime and iron. Doubtless there are many chemicals to be had from the products of this great laboratory of nature. An American journal remarks that were such an "institution" in that country it would have been utilized ere this.

SOCIETY OF PUBLIC ANALYSTS.

Analyses of English Public Water Supplies in October, 1882. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Date when drawn.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine in Chlorides.	Phosphoric Acid in Phosphates.	Nitrogen in Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in: 15 mins. at 80° Fahr.	Oxygen, Absorbed in: 4 hours at 80° Fahr.	Hardness, Clark's Scale, in degrees: Before Boiling.	Hardness, Clark's Scale, in degrees: After Boiling.	Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
Kent Co.	Oct. 19	bluish	none	1·84	none	·29	·0029	·0043	trace	·032	20 0°	5·5°	35·2	satisfactory	Wigner & Harland.
New River	„ 21	c. f. yellow	none	1·09	trace	·14	·0018	·0021	·002	·007	16·0°	5·0°	21·3		B. Dyer.
East London ..	„ 19	c. yell. green	none	1·20	none	·08	·0056	·0033	·016	·060	13·0°	3·2°	19·4	satisfactory	Wigner & Harland.
Southwark & Vauxhall ..	„ 19	c. p. y. & clear	none	1·24	none	·18	·0007	·0049	·028	·053	14·0°	3·5°	19·3	none	John Muter.
West Middlesex	„ 30	c. yell. green	none	·95	trace	·10	·0007	·0052	·069	·137	13·0°	4·0°	18·5		O. Hehner.
Grand Junction	„	pale straw	none	1·24	trace	·17	·0005	·0048	·021	·068	13·3°	3·4°	19·6		A. Wynter-Blyth.
Lambeth	„ 19	c. p. y. & clear	none	1·24	trace	·17	·0007	·0049	·026	·050	14·5°	4·0°	19·6	none	John Muter.
Chelsea	„ 19	c. p. br. yell.	none	1·23	trace	·18	·0007	·0045	none	·026	13·7°	4·0°	19·3		A. Dupré.
Birmingham ..	„ 2	c. gr. yellow	none	1·12	trace	·69	none		·091	·245	10·5°	4·4°	15·0	none	A. Hill.
Bolton	„ 16	s. yell. & turbid	s. mossy	·48	none	·02	·0018	·0080	·033	·062	3·6°	3·4°	7·8		W. H. Watson.
Brighton......	„ 10	c. p. blue	none	5·39	trace	·25	trace	·0032	none	·010	12·0°	4·6°	25·2	veg. debris	Wigner & Harland.
Bristol........	„ 9	brnsh. green	none	·86	none	·06	·0002	·0050	·023	·034	13·7°	2·3°	19·0	sand veg. debris	F. W. Stoddart.
Cambridge	„ 20	c. p. blue	none	1·40	trace	·40	·0010	·0020	none	·020	17·0°	5·5°	24·5	satisfactory	J. West Knights.
Edinburgh	„ 16	s. brown	faint	·88	s. trace	trace	trace	·0056	·016	·134	3·9°	3·7°	4·8	none	J. Falconer King.
Exeter	„ 16	f. b. yellow	none	·84	s. trace	·15	none	·0029	·037	·063	2·7°	2·7°	6.3		F. P. Perkins.
Hereford	„ 25	clear colourless	none	1·25	none	none	·0012	·0025	·001	·008	5·0°	2·8°	5·0°	none	G. J. Stephens.

SOCIETY OF PUBLIC ANALYSTS.

Analyses of English Public Water Supplies in October, 1882. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Date when drawn.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine in Chlorides.	Phosphoric Acid in Phosphates.	Nitrogen in Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in: 15 mins. at 80° Fahr.	Oxygen, Absorbed in: 4 hours at 80° Fahr.	Hardness, Clark's Scale, in degrees: Before Boiling.	Hardness, Clark's Scale, in degrees: After Boiling.	Total Solid Matter, dried at 230° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
Liverpool	Oct. 26	yell. green	s. peaty	1·08	trace	·05	·0028	·0042	·014	·073	3·5°	2·9°	7·5		A. Smetham.
Maidstone—															
Wtr. Company	,, 17	c. green	none	2·40	trace	·58	·0014	·0028	·014	·060	17·2°	7·0°	33·5	none	M. A. Adams.
Public Conduit	,, 17	c. blue	none	2·20	trace	·59	none	·0014	·004	·009	17·5°	7·0°	33·2	none	M. A. Adams.
Manchester....	,, 25	s. turb. s. yell.	none	·73	trace	none	·0027	·0078	·078	·146	1·7°	1·7°	4·4	satisfactory	W. Thomson.
Northwich	,, 14	green yell.	none	3·00	h. trace	·10	·0004	·0020	·110	·187	11·0°	7·0°	18·2	diatoms, veg. deb., &c.	C. M. Blades.
Norwich	,, 9	p. grnsh. yell.	none	2·00	trace	·08	traces	·0120	·039	·090	12·5°	6·5°	16·0		W. G. Crook.
Nottingham ..	,, 17	c. p. blue	none	1·20	none	.84	·0029	·0034	trace	·020	8·2°	7·0°	15·4	veg. debris	Wigner & Harland.
Portsmouth ..	,, 17	turbid reddish	none	1·20	trace	·17	traces	·0126			13·5°	2·3°	18·5	veg. deb., movg. org. diat.	W. J. Sykes.
Rugby	,, 9	c. p. yellow	none	1·30	h. trace	·07	·0060	·0102	·040	·096	13·5°	7·5°	19·4	veg. deb., diatoms	A. P. Smith.
Salford	,, 13	yellow	none	·60	none	trace	·0007	·0014	·022	·098	3·0°	2·5°	5·0		J. Carter Bell.
Southampton ..	,, 26	v. t. orang. yel.	none	·99	trace		trace	·0168	·054	·159	11·3°	3·3°	18·3	veg. deb., diat., organisms	A. Angell.
Swansea	,, 25	s. turb.	none	1·00	trace	none	·0014	·0056	·003	·004	1·5°	1·4°	4·0	earthy matter	W. Morgan.
*Worcester	,, 16	p. yell. s. turb.	none	2·15	trace	·21	·0005	·0084	·023	·153	16·2°	7·5°	24·4	veg. deb. animal	W. E. Porter.

Abbreviations:—c., clear; f., faint; h., heavy; p., pale; v. h., very heavy; v. s., very slight.

* The River at this date was rising fast, and the water was much discoloured.

ERRATA.—September Table.—Chelsea Water, Oxygen absorbed in 4 hours should be ·080 instead of ·003; Birmingham Water, Ammonia should be ·0014 instead of ·1014; Norwich Water, Vegetable Debris should not have been inserted.

THE SOLUBILITY OF BORIC ACID IN GLYCERINE.*

By David Hooper.

Professor Barff's "Boro-glyceride," and still later the glycerborate of calcium and the glycerborate of sodium, described by M. Le Bon in the *Comptes Rendus*, xcv., 145, have created a demand for these antiseptics. Mr. Hooper's experiments were directed to the elucidation of the solubility of the one substance in the other at various temperatures. Especial care was taken to ensure absolute purity of the two substances. The result of a number of determinations showed a regular progression of solubility as the temperature was increased. Thus at 0° C. 100 of glycerine dissolve 20 of boric acid; at 25°, 30 parts; at 50°, 43 parts; at 75°, 58 parts; and at 100°, 72 parts.—*Chemist and Druggist.*

REVIEWS.

Sugar Growing and Refining.

By Charles G. Warnford Lock, G. W. Wigner, and R. H. Harland.

London: E. & F. N. Spon, 16, Charing Cross.

This work (which extends to 750 pages, and is illustrated by 215 plates and engravings) is a comprehensive treatise on the culture of sugar-yielding plants and the manufacture and analysis of sugar. It also contains subject matter upon milk and starch sugar, and on the distillation of rum. Any criticism of this book in these columns would be manifestly out of place, and we can only sketch the outlines of the work, leaving our readers to see for themselves and form their own opinion of its merits. The book commences by a short notice of the general chemistry of sugars, and then we have seven chapters devoted respectively to the culture of the cane, composition of the juice, extraction, defecation, and concentration of the same, and to the granulation and curing of the sugar. Next after cane we find five chapters devoted to beet-root, on the same plan, and one each to maple, milk, palm, maize, and starch sugars. Then follows a long section on sugar refining, with a summary of all the patents which have been from time to time taken out in this matter, and another equally complete on the analysis of sugar both by the optical and chemical methods. Although this portion of the work is exhaustive, yet it also aims at being concise, and only the best processes, which have been thoroughly proved in the laboratory of the authors of the section, are recommended. The authors, in addition to each bringing his own special experience to bear on his own section, have consulted such other acknowledged authorities as Messrs. B. E. R. Newlands and Maxwell Lyte, as well as several large sugar planters.

Handbook of Volumetric Analysis (Fourth Edition).

By F. Sutton, F.C.S., F.I.C. London: J. & A. Churchill, New Burlington Street.

The fourth edition of this book has been on our table for some time. We should have reviewed it earlier, but that it is already so well known to all English-reading chemists that we should fancy any recommendation of it unnecessary. The fact that the book has reached a fourth edition speaks for itself; but further than that, each edition appears to bring in not only improvements in the old processes described, but considerable changes in the way of addition of new processes which are of value for those special analyses which

* Read at the meeting of the British Pharmaceutical Conference.

have become now the practical necessity of commercial work. The author says that he has done his best to eliminate the good from the bad, and after a careful perusal of his work we think he has done so, and that in the most satisfactory way. We suppose that no Analyst in practice is without a copy of *Volumetric Analysis*, but even those who have a copy of the older editions only, would gain in some respects by procuring this new edition also.

Manual of Colours and Dye Wares (Second Edition).

By J. W. Slater. London: Crosby, Lockwood, & Co., Stationers' Hall Court.

We do not like the title of this book at all—in fact the title is almost its worst feature; it would have been much more appropriate to have named it "Dictionary of Dyes." It is quite true that there are some other details comprised in it, which fairly belong to the head of testing dyes, say for instance a note of some twenty lines as to acidimetry, and a few useful tables, but essentially it is neither more nor less than a dictionary work, or as, perhaps, the word is more applicable, a *directory* of the different colours in use by dyers at the present time; and not colours only, for mordants, gums, and all the different substances that come under the category of dyers' materials, are referred to. Therefore, had the book been described under the title we have mentioned, we should have said that it was a most valuable work of reference, and one which should be bought and read by every chemist who directly or indirectly had anything to do with dyeing matters.

We have examined the information contained in the volume, and there is no question that as a whole it is extremely satisfactory in character. The index is however not by any means so complete as it might be; a good many of the colours in common use are not indexed under their commercial names, but only under their special trade names, and it is difficult therefore to find such an article which needs to be referred to, while the information as to the ordinary analytical processes of alkalimetry and acidimetry, which should really find no place in a book of this kind, are inserted in such an imperfect manner that it is necessary to refer to other books dealing with those particular subjects. Dealing with its own matters, the book is past reproach, but where it goes beyond the bounds of what it should fairly touch, there are errors in it which we regret. Passing these by, and viewing the work simply as a dictionary of dyeing materials, it is the most handy book we have seen for some years.

THE ALLEGED DEATH FROM LEAD POISONING AT KEIGHLEY.

The inquest concerning the death of Mr. Wilson Riley, machinist, Belgrave Road, Keighley, which took place in August from the effects, it is supposed, of lead poisoning, was held on the 26th ultimo by adjournment in the Keighley Petty Sessional Court, before Mr. T. P. Brown, coroner. The inquest had been adjourned for a month, and the viscera of the deceased, together with samples of the town's water taken after it had passed through the pipes, were sent to Mr. Allen, the Public Analyst for the West Riding, for examination. Mr. E. Tindal Atkinson, barrister, appeared for the Keighley Local Board.

Police-Inspector Tebbutt stated that he duly delivered the viscera and the samples of water to the Public Analyst of the West Riding.

The Coroner then read the following report, sent in by Mr. Allen :—

"I have duly examined the viscera of Wilson Riley, deceased, brought me, on August 30th, by Inspector Tebbutt, and have obtained the following results :—In one kidney I found a doubtful trace of

lead. The second kidney gave an identical result. In one half of the heart I found no lead. In a portion of the brain I found no lead. In one half of the liver and spleen I found a notable quantity of lead, and a distinct trace of copper. The copper being very small in amount I did not determine it. The quantity of lead separated from the half-liver and spleen was 0·125, or ⅛th grain. This amount is smaller than one might expect to find in the liver of a person who was poisoned by lead, but I have not unfrequently noticed very insignificant amounts of lead in the viscera of cows and other animals which undoubtedly met their death by lead poisoning. What strikes me as somewhat more remarkable is the almost entire absence of lead from the other organs. I am unable to find any records of the amounts of lead found by other observers in cases of death by chronic lead poisoning, the absence of such data being not improbably due to the comparatively rare instances in which inquiries have been made under such circumstances; the patients most frequently recovering, or the cause of death being so apparent that no analysis has been made. I attach no importance to the presence of the trace of copper in the liver, as I have met with it in several other instances.

"I have examined the sample of water in the smaller of the two bottles received, marked 'Quart of water drawn from tap in dwelling-house No. 68, Belgrave Road, Keighley.' It contained 0·61, or about 3-5ths of a grain of metallic lead per gallon of the water. This proportion is amply sufficient to produce poisonous effects. Some persons appear to be much more sensitive to the influence of lead than others; but, speaking generally, anything over 0·1 (1-10th) of a grain of metallic lead per gallon of water must be regarded as a decidedly dangerous contamination. I have myself known 0·2 (equal to 1-5th) of a grain of lead per gallon to produce severe symptoms of lead poisoning. I have also examined the water in the larger bottle received, marked 'Quart of water drawn from main in Highfield Lane, Keighley.' It contained no trace of lead. It contained a distinct trace of mineral acid. By remaining in contact eighteen hours with a strip of clean lead the water became contaminated with lead to the extent of 0·56 (over half) grain of lead per gallon. A repetition of the experiment showed that 0·45 grain of lead was taken up in fourteen hours. As already explained, these proportions of lead would render the water highly injurious to a person who drank it regularly. When the water in question was rendered faintly alkaline with lime water and left in contact with lead over one night, it took up the smaller quantity of 0·14 grains of lead. I consider this and analogous experiments show that it is the free acid in the water which gives it so great a tendency to act on lead, and that this property is in a great measure destroyed by getting rid of the acid. I found that Sheffield water took up merely a trace of lead during one night, but in presence of a very minute proportion of acid the action on the metal was notably increased. Rotherham water took up no trace of lead even after two nights' contact with the metal."

Examined by Mr. Tindal Atkinson, Mr. Allen stated that he was surprised at the small quantity of lead found in the tissues, considering that the person was supposed to have died from lead poisoning. It was, however, possible that some of the lead might have been eliminated by medical treatment. It would linger longest in the liver, except, perhaps, in the bones. He had had no experience of fatal cases of lead poisoning in human beings, but he had seen many cases in animals. He believed that a fortnight's medical treatment would serve to eliminate all traces of lead from the system. Iodide of potassium was an agent which would so eliminate lead, but he should expect that the organs would show traces of deterioration.

Mr. William Dobie, M.D., examined by Mr. Atkinson, said he did not consider the state of the kidneys as shown by the *post-mortem* examination to be such as to account for death. They were in an advanced stage of disease, but not in an extremely advanced stage. He believed that the disease of the kidneys had not advanced sufficiently to cause death. They were in the ordinary stage of "granular kidney." The most important causes of that disease were gout, rheumatism, intemperance, and lead poisoning. The last-named was a very common cause. Of forty-two cases of lead poisoning treated in a London hospital, in twenty-six there was suffering from granular kidney. Excessive mental depression, with anxiety, was also recognised as a cause of the disease. He should expect to find some symptom of paralysis in lead poisoning; but that was not a necessary symptom. In answer to the Foreman of the Jury, Mr. Dobie said he was of opinion that the deceased died from lead poisoning. In the first place lead poisoning was a common cause of the diseased state of the organs shown by the *post-mortem* examination; then, during life, the deceased had shown unmistakable signs of lead poisoning; and lastly, the analysis of the viscera has shown the presence of lead in the tissues after death.

Mr. Jack, surgeon, gave similar evidence, and stated that he administered iodide of potassium to the deceased some ten or twelve days before his death.

After the examination of a few other witnesses, who deposed as to the laying of the service pipes,

Mr. Tindal Atkinson said that he had to apply on behalf of the Local Board for another adjournment, in order that they might have the evidence of Mr. Tidy, of London, a gentleman who had attended fifty cases of deaths from lead poisoning. The Board regarded his evidence as absolutely necessary to the verdict.

The inquest was accordingly adjourned for a week.

On the resumption of the inquiry on the 3rd October, Charles Meymott Tidy stated that he was a Bachelor of Medicine, Master of Surgery, Professor of Chemistry, and Medical Adviser to the Home Office. He had had a large experience in cases of lead poisoning, the number of cases with which he was acquainted being sixty. He was frequently called upon to make analyses for the detection of poisons. In all the cases of alleged deaths from lead poisoning that had come before him he found that lead poisoning was not the actual cause of death, although in some cases it had preceded death for some time. He had never seen a case of chronic lead poisoning. Nearly all the cases had been under medical treatment. He knew of no well-recorded case of death from chronic lead poisoning. He had read the evidence in regard to the present case very carefully. He was of opinion that death might have resulted perfectly independent of lead poisoning. When the latter disease was much advanced there was always paralysis of the extensor muscles, either more or less. He knew of no case of chronic lead poisoning in which there had not been paralysis in some form or other. In nine out of ten cases the extensor muscles had been affected, producing the appearance of the hand popularly called "drop-wrist"—resulting from the want of power to hold the hand up. He should expect to find that symptom in any case of advanced lead poisoning. The muscles were in all cases affected before the nerve centres. There was no exception to that statement. That was his experience, to which there had been no exception. He would expect to find a state of coma under these conditions. He would not expect to find any affection of the nerve centres such as delirium preceding the paralysis of the muscles. He would make that statement with some reservation, because the affection of the nerve centres took different forms in different people. The condition of the muscles in the case of "drop-wrist" was that the muscles were much paler. In some cases they were almost white. He could not understand that part of the evidence which referred to "drop-wrist" as a *post-mortem* symptom. It was a life symptom. It was stated that the muscles were healthy, whereas he held that "drop-wrist" was the result of a disease in the muscles. If the symptom had been there before death he held that it would have been easily noticed by those around the deceased. It was a sign too apparent to escape observation. With regard to the stated enlargement of the intestines, as far as he understood the evidence there had been constriction of the ascending colon only; but his experience was that the whole colon was in these cases more or less restricted. There was an entire absence of inflammation which would account for that constriction. In this case it was stated that the mucous membrane of the follicles was enlarged. That would indicate to his mind that local inflammation had set in. It would be a symptom of local inflammatory action rather than the action of poison which affected the general system. In some cases granular disease of the kidneys resulted from lead poisoning. He had read the report furnished by Mr. Allen, the Public Analyst. He agreed with Mr. Allen, that in the case of a death from lead poisoning he would expect to find a greater quantity of lead in the organs of the deceased. In five very distinct cases where there had been lead poisoning—in one, especially, which he remembered, he made an analysis of the liver and the spleen, and he found five grains of lead in the spleen, and four grains in the liver, yet death was not primarily caused by lead poisoning. The patient had been in the hospital, and had been sent out and was brought in again, having been run over by a cab, from which accident he died. Iodide of potassium was one of the agents used in treating cases of lead poisoning, but it was not now so extensively relied upon. It was difficult to state the exact course that the lead would take in the system, but he would state that it was more generally located in the spleen than in the liver. But in cases where the general health was low lead would be liable to act with most pernicious effects. Lead was, however, sometimes found in the bodies of men exposed to its influence, yet there was no symptom of poisoning in these men. He referred to workers in lead works, painters, &c.

In reply to the Coroner, who asked if it was quite possible that all traces of lead might be eliminated by medical treatment extending over eight or ten days, Dr. Tidy said that that was a very difficult question to answer. Iodide of lead was an insoluble body. When they wished to make an estimate of the amount of lead in any material they added iodide of potassium, when the lead was precipitated, being rendered insoluble and inert. The lead in the organs would still be kept there, but it would be rendered harmless. In this case he did not admit that the small quantity of lead found in the organs of the deceased was owing to the medical administration of iodide of potassium, and if death had resulted from lead poisoning there would have been a larger quantity found in the deceased's body. Mr. E. Tindal Atkinson—Having read the evidence in this case, do you think that lead poisoning was the primary cause of death? Dr. Tidy—Well, of course, it is a very difficult thing for one who was not present at the *post-mortem*, and had not an opportunity of seeing the symptoms during life, to give an opinion, especially in opposition to such an able man as Dr. Dobie; but I must say, having considered the facts—the granular state of the kidneys, the exceedingly small quantity of lead found in the deceased after death—considering the absolute absence of all the symptoms of lead poisoning, except the blue mark on the gums and colic, there being no "drop-wrist," no paralysis, no coma—I should think that death resulted from granular disease of the kidneys. Of course I will not assert that the granular disease was not produced by lead poisoning. It is very likely that it would be accelerated by drinking water in which there was lead. There was, however, no evidence to show that the nerve centres had been affected. There was no paralysis—at least none observed before the *post-mortem* examination was made.

Some further evidence was then given, and the jury retired, and after an absence of two hours they brought in the following verdict:—"We find that the deceased Wilson Riley died from granular disease of the kidneys, but how caused we are unable positively to say, but we believe it was accelerated by lead poisoning."

LAW REPORTS.

Refusing to Sell, and Adulteration of Milk:—

Stamford Smith, of Wawne, was summoned by the Urban Sanitary Authority of the Hull Corporation for two offences under the Adulteration Act. Mr. A. Wilson, Deputy Town Clerk, appeared for the prosecution. The offences were proved by Mr. Osborne, the Nuisance Inspector, and Mr. Thackeray, his assistant. It appeared that on the 16th July the defendant was selling milk on the Beverley Road, and the officers requested him to sell them a sample for analysis. He declined to do so, and said that if they would wait ten minutes he would get them some. They watched him go to a house and sell a pint of milk. This milk the officers subsequently succeeded in obtaining from the person to whom it was sold, and on analysis it was found to be adulterated with twelve per cent. of added water. The defendant was therefore summoned under the Act for refusing to sell milk to the authority when requested, the penalty for which was £10, and also for adulterating it, which rendered him liable to a penalty of £20. Defendant said it was not his intention to evade the law. Mr. Twiss fined him £5 and costs for the first offence, and 50s. and costs for the second. Defendant: Your Honour, this is a very serious matter for me. I'm sure I can't pay it at present. Mr. Twiss: It is a very serious matter for the public that they can't get the article they ask for.

Butter and Coffee Adulteration:—

At the Dartford Petty Sessions lately, Mr. Allen Groombridge, grocer, Dartford, was summoned for having, on August 11, sold, to the prejudice of Police-constable Conford, half-a-pound of butter at 1s. 2d. per lb., and half-a-pound of coffee at 1s. 4d. per lb. The articles were sent to the County Analyst for examination, and his report stated that the "butter" contained no butter at all, and that the "coffee" contained 60 per cent. of chicory. Defendant admitted that the butter was what was known in the trade as "bosh" butter, and that he had sold it for twenty years. The coffee, he said, was "what is usually sold to poor people." He was fined £2 in each case, and £1 costs.

Adulterated Milk:—

Robert Allen, of Ruxley Farm, St. Mary Cray, was summoned for selling adulterated milk.—Mr. Gregory appeared in support of the complainant.—Mr. Edward Brocklesby, a dairyman, of Bexley Heath, deposed that he had been in the habit of purchasing milk from the defendant, and retailing it. On Tuesday, the 6th ult., witness went with Mr. Parrish to receive the milk, and after it was put in the

churn, he took a sample of it in three bottles, one of which he sent to the analyst, one to the defendant, and one he kept himself.—In answer to the defendant as to why he did not take the sample out of the defendant's churn, witness said he thought he could only do it after delivery. Swore he had not brought a mixture and put it into the milk on previous occasions, nor had he brought a bottle with something in it to add to the milk. He owned cows himself, but did not know that the milk was sometimes poorer than at others, although it might be so after the cow had just calved. Witness had made frequent complaints of the poorness of the milk. The analyst had found that there was 14 per cent. of added water in the sample tendered to him. Did not know that the defendant had dismissed a cowman some time ago on account of the complaints made by witness. He had not told the man that the milk had got so bad that he was unable to add the usual six quarts of water to every churn. Did not know what milk was made of, but understood that the analyst meant there were 14 parts of added water. Did not know that there was water in milk in its normal state.—Alfred Parrish stated that he was with the last witness on the 6th ult., and assisted him to take the samples and seal the bottles. Previous to this they had called the attention of the defendant's man to see that there was no water at the bottom of the churn in which the milk was transferred. Witness did not know the properties of milk.—A discussion ensued as to whether the milk had become the property of complainant, but Mr. Gregory contended that according to the Act the milk that had been sold would have prejudiced the purchaser.—John Baxter said he had delivered the milk to the complainant on the 6th, and he had often received complaints as to the bad quality of the milk. The cows had been suffering from a fever, and could not properly digest their food, and this was why the milk was not so good as usual. To witness's knowledge the complainant had used some "colouring" for the milk, which he afterwards passed off as nursery milk. Complainant had frequently told witness that the milk was so poor that he could not add the usual six quarts of water to the barn gallon. Although the cows were being physicked with turps, salt, and sulphur, the milk was being sold as pure. The physic was being given to three cows, but it could not get into their veins. The complainant's churn, into which the milk was emptied, was not clean. Complainant knew the cows were being physicked.—The Bench, after some deliberation, said they had fully considered the case, and it was not one in which they could convict. There was a difference of opinion as to the quantity of water in milk in its normal state, and as the milk was likely to have been poor owing to the sickness of the cows, and the cowman's evidence as to the milk being taken out of the complainant's churn, the summons would be dismissed.

"Pure Mustard:"—

At Norwich recently, John Broughton, grocer, Friars-street, was charged with selling mustard adulterated with flour on September 18.—Sergeant Taylor said he went into defendant's shop in plain clothing and asked for a half-pound of mustard for the purpose of having it analysed by the Public Analyst. He paid 6d. for what was supplied to him,and the mustard was divided into three parts, one of which was returned to the defendant, one kept by the police, and one sent to the analyst. Defendant did not supply a label stating the mustard was a mixture. It was taken from a can labelled "Keen's Mustard." He told defendant the mustard was for the analyst, when it was on the scale, and defendant said he did not know if it was adulterated; it was just as he had it supplied to him.—Mr. Ware, who prosecuted, said the mustard had been submitted to the Public Analyst, who found it to contain a percentage of flour.—Defendant said he told the officer he had reason to suppose the mustard was adulterated.—Mr. W. Johnstone, Public Analyst, was called, and put in his certificate of analysis. He said pure mustard was sold in the town, and several pure samples had been submitted to him for analysis. The adulterated mustard was of the same colour as the pure article, as, after the addition of the flour, it had been coloured with turmeric. Messrs. Colman and Messrs. Keen always affixed labels to their tins stating whether they contained pure mustard or a mixture.—Defendant: I told the policeman I did not know if the mustard was pure. I had been reading an article in the paper on some recent prosecutions of tradesmen for selling adulterated mustard, and the article said the manufacturers ought to pay the fines.—The Mayor: You knew it was adulterated, and you said nothing until you were told it was to be analysed.—Defendant: I did not sell it as pure mustard.—Mr. Ware: Even then he has not complied with the law; he should have given a label. We don't wish unduly to press the case.—Mrs. Maria Salmon, Windsor-road, was called upon to answer a similar charge. The circumstances of

the sale were deposed to by the officer, who paid 8d. for the half-pound of mustard supplied.—Defen said she was very sorry if she had broken the law. It was Colman's mustard, and she bought it as mustard for anything she knew.—A Magistrate: Then you must come upon the people who sold you for what it costs you to-day.—Mr. Ware said they did not press the case.—The Mayor said must protect the public, and should mark their displeasure by imposing fines. However, they w give defendants the benefit of the doubt as to whether it was sold wilfully. Mr. Broughton wou fined 1s. and 8s. costs, and Mrs. Salmon 1s. and 7s. costs; but if defendants came before them a they would be fined £20.

At the meeting of the Salford Council recently the Public Analyst (Mr. J. Carter-Bell) rep that during the quarter ending September 30th, he had analysed 129 samples of milk, bread, dr beer, flour, syrup, sardines, and water, and of these thirteen were found to be adulterated. The adu ated articles were milk, beer, and syrup.

Wooden hams and nutmegs have not been unheard of as articles of trade, but wooden cloves to be a new invention. An East India paper publishes as a fact, that several bags of cloves receiv London from Zanzibar were mixed with artificial cloves made from wood by machinery. The cl were made of soft deal, stained a dark colour and soaked in a solution of essence of cloves to scent t

RECENT CHEMICAL PATENTS.

The following specifications have been recently published, and can be obtained f the Great Seal Office, Cursitor Street, Chancery Lane, London.

No 1882	Name of Patentee.	Title of Patent.
493	C. J. Allport	Preparation of Asbestos as an Insulating Material .. ..
700	J. S. Williams	Generation, Storage, &c., of Electricity .. .. ..
766	Ditto	Ditto Ditto .. ..
856	Ditto	Ditto Ditto .. ..
969	J. P. Kagenbusch	Extracting and Separating Metals from Silicious, Aluminious, and Other Substances .. ..
981	W. Howitt	Treating Dynamite to Remove its Liability to Explosion ..
1029	F. Wright and M. W. Mackie	Incandescent Electric Lamps .. ..
1036	H. Liepmann & P. S. Looker	Manufacture of Carbons for Electrical Purposes .. ..
1044	R. and M. Theiler	Telephone Transmitters .. ..
1055	H. H. Lake	Manufacture of Sugar .. ..
1057	C. Scheibler..	Manufacture of Sugar .. ..
1058	J. Moris	Process for Production of Aluminium .. ..
1079	W. Crookes	Incandescent Electric Lamps .. ..
1156	J. Mactear	Manufacture of Soda and Potash .. ..
1163	W. R. Lake	Electric Lighting Apparatus .. ..
1167	G. C. Trewby	Purification of Gas, &c. .. ..
1172	J. Wanthier..	Incandescent Electric Lamps .. ..
1199	R. Kennedy..	Electric Lamp .. ..
1201	R. Matthews	Dynamo-Electric or Electro-Dynamic machines .. ..
1220	C. Wigg	Manufacture of Chlorine .. ..
1266	J. H. Johnson	Manufacture of Artificial Indigo.. .. ..
1879	W. R. Lake	Manufacture of Saccharine Compounds .. .. ..

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Pr The Pharmaceutical Journal; The Sanitary Record; The Miller; Journal of Applied Science; Provisioner; The Practitioner; New Remedies; Proceedings of the American Chemical Soci Le Practicien; The Inventors' Record; New York Public Health; The Scientific American; Soc of Arts Journal; Sanitary Engineer of New York; The Chemists' Journal; Weekly Drug Ne Sugar Cane; Country Brewers' Gazette; The Medical Record; The Canada Lancet; Gas and W Engineering; The Grocers' Gazette; Columbia School of Mines Quarterly Magazine; London W Supply, by Crookes, Odling and Tidy; Chemical Review.

THE ANALYST.

DECEMBER, 1882.

SOCIETY OF PUBLIC ANALYSTS.

A GENERAL MEETING of this Society was held at Burlington House, Piccadilly, on Wed-
nesday, the 15th November.

In the absence of the President, the chair was taken by Dr. Muter, Vice President.

The following gentlemen were proposed for election :—

As Members: E. J. Day, M.R.C.S., F.C.S., Public Analyst for Dorchester; Professor
C. R. Fletcher, Boston, Mass., State Assayer; G. T. Stephens, B.Sc., Widemarsh,
Analytical Chemist.

As Associates: C. Brisley, Assistant to Dr. Bernays; F. W. Simpson, Assistant Analyst
to Midland Railway Company.

The following papers were read and discussed :—

"Notes on Commercial Albumin," by A. H. Allen.

"On the Diminution of the Total Solids in Milk by Decomposition," and "A Point
Concerning Milk Control," by Dr. Vieth.

"On the Proportion of Dextrin to Maltose in Malt Worts," by J. West Knights, F.C.S.

The next Meeting of the Society will be held at Burlington House, on Wednesday, 13th
December, and among the papers to be read will be one by Mr. C. T. Kingzett, on "Some
Analyses of Asphalte Paving."

NOTES ON COMMERCIAL ALBUMIN.

BY ALFRED H. ALLEN.

Read before the Society of Public Analysts on 15th November, 1882.

THE applications of albumin are now very numerous, and as it differs much in quality, according to its origin and the details of its preparation, it is sometimes necessary to ascertain its purity and freedom from adulteration.

Commercial albumin is obtained chiefly from two sources—eggs, and the serum of blood. Fish-albumin is also met with occasionally, and may be recognised by its fishy odour.

Blood or serum-albumin is obtained by separating the serum from the clot of perfectly fresh blood. The liquid is evaporated in shallow trays, at a temperature not exceeding 50° C., when the albumin is obtained in brittle scales or transparent flakes of a greyish, yellowish, reddish, brown, or black colour. The qualities of serum-albumin, made by leading firms, are "refined," "prime," "No. 1," "No. 2," and "black." *Refined* is made from highly rectified serum, and is of a dirty yellow colour, and, like *prime*, is employed for printing delicate colours. No. 1 is darker in colour and less valued, though suitable for all ordinary printing purposes. No. 2 quality is made from the second draining of the

serum, which, after the clear top serum has been syphoned off, is more or less tinged with red, and consequently is only fit for printing dark colours; as a rule, it also contains some insoluble matter, which is objectionable. *Black albumin* or "dried blood" is obtained from the last portions of serum, and is almost black in colour. It is not used in calico-printing, but finds applications in sugar-refining and turkey-red dyeing. The clot, left after separation of all serum, consists chiefly of fibrin and blood-corpuscles, and is dried, roasted, and used as manure.

Serum-albumin may be employed for printing all but the very finest and brightest colours. Perfectly colourless blood-albumin, equal to the finest egg-albumin, is said to have been recently produced in Germany.

Egg-albumin is obtained in a solid state by cautiously evaporating the white of eggs, at a temperature below 50° C. It is generally transparent, and of a light yellow colour. It is more valuable than serum-albumin, and consequently is more liable to adulteration. Two genuine qualities are made. Egg-albumin should be free from blisters, which are often present in partially coagulated samples.

Albumin of good quality is recognised by its transparency when in flakes, by its taste, not being disagreeable, and by having no odour of putrefaction. Treated with cold water, with constant stirring, it should dissolve entirely.*

Commercial albumin is liable to adulteration with gum, dextrin, flour, sugar, &c. For its examination, 5 grammes of the powdered sample should be treated with 50 c.c. of cold water, with frequent stirring, until all soluble matter is dissolved. Pure and good samples leave no residue. A few drops of acetic acid should next be added, and any undissolved matter filtered off through silk or fine muslin. It may consist of coagulated albumin, casein, starch, or membranous matter. The casein may be dissolved out by treatment with very dilute caustic soda, and precipitated by exactly neutralizing its solution with acetic acid. The aqueous solution of the sample is boiled, when the albumin is thrown down as a flocculent precipitate, which may be filtered off, washed, and weighed; or ignited with soda-lime, and the albumin deduced from the ammonia obtained. The filtrate should be treated with acetic acid and potassium ferrocyanide to make sure that no albuminoid remains in solution.† Its absence being proved, tannin may be added to precipitate any gelatin; and the filtrate concentrated to a small bulk and treated with alcohol to precipitate any gum or dextrin, while sugar, if present, will remain in solution in the alcoholic liquid, and may be detected by boiling off the alcohol, heating with hydrochloric acid, and testing the liquid with Fehling's solution. Sugar might also be extracted by treating the original solid sample with alcohol.

Ziegler's method of assaying commercial albumin is to dissolve 20 grammes of the sample in 100 c.c. of cold water, strain through a sieve, and add 10 c.c. of the clarified liquid to a

* For practical purposes, the albumin is best dissolved in warm water, of a *maximum* temperature of 45° to 50° C. The albumin should be added gradually, and the liquid constantly stirred. The water should on no account be added to the albumin. The liquid, after straining through a fine silk sieve, is usually mixed with a small proportion of ammonia, turpentine-oil, &c., in order to prevent frothing and make it work smoothly. Turpentine also tends to prevent putrefaction, but an addition of about 1 per cent. of arsenious oxide is said to be the best preservative.

† Any precipitate produced at this stage will probably consist of casein.

boiling 20 per cent. solution of alum. After noting the appearance and volume of the coagulum, it is washed, dried, and weighed. De Coninck (*Journ. Chem. Soc.* xxv., 1129) finds that the process gives a precipitate containing not more than 1 per cent. of alumina, and that it is sufficiently accurate for the purposes of the calico-printer. With pure albumin very good results are obtainable, and their accuracy is not affected by the presence f dextrin, but gum-arabic prevents the precipitation of albumin to a very notable extent.

I have made some observations on the proportion of ash yielded by various qualities of commercial albumin, and the results have some interest, although they are not applicable to the detection of any special adulterants. The proportion of ash cannot be readily ascertained by direct ignition of the albumin, owing to the fusible nature of the carbonate of sodium and other salts of which the ash is mainly composed. The difficulty may be obviated by treating a weighed quantity of the sample in a porcelain crucible, with nitric acid of 1·42 specific gravity and two or three drops of strong sulphuric acid. On heating gently, the albumin dissolves to a clear yellow liquid, which may be evaporated to dryness without trouble, giving a residue which readily burns and leaves an ash of tolerably high melting point. Operating in this manner, Mr. J. C. Belcher obtained in my laboratory the following percentages of "sulphated ash" from a series of samples of commercial albumin manufactured by a leading firm :—

	Sulphated Ash.
"No. 1" Egg Albumin	7·4 per cent.
"No. 2" " "	7·0 " "
"Refined" Blood Albumin	9·1 " "
"Prime" " "	8·5 " "
"No. 1" " "	9·2 " "
"No. 2" " "	8·9 " "
"No. 3" " "	9·7 " "
"Black" " "	6·2 " "

All the ashes were white, except that yielded by the black albumin, which gave a reddish ash, owing to the presence of blood-corpuscles in the original sample. Curiously enough, in this, the lowest grade of genuine albumin, the ash is less than in the better kinds.

ON THE PROPORTION OF DEXTRIN TO MALTOSE IN MALT WORTS.

By J. West Knights, F.I.C., F.C.S.

Read before the Society of Public Analysts on 15th November, 1882.

In brewing, the proportion of dextrin to maltose produced in the mash is of the greatest importance, as the character of the beer will almost entirely depend upon it.

Now that proportion is subject to considerable variation, and will depend upon—firstly, the temperature of the mash, which will determine the proportions of dextrin and maltose initially formed by the splitting up of the starch molecules; secondly, the duration or length of time the mash is subjected to the action of the diastase, which will determine the proportion of dextrin subsequently converted into maltose; and thirdly, the diastatic activity of the particular sample of malt under treatment, and to a slight extent the nature of the water used for mashing, which will determine the rate of the subsequent conversion of dextrin into maltose. The influence of the proportion of dextrin on the fermentation of

the wort is of course very great, dextrin being only capable of undergoing a very slow fermentation, and the result is that the final attenuation of a highly dextrinous wort is very high, too high to admit of ready clarification by ordinary methods of fining, but such a beer would be well adapted for keeping—or stock-beer; and on the other hand a wort low in dextrin will produce a low gravity beer which, although it would clear readily, would be thin drinking and *apparently* much weaker than a beer of the same original gravity but higher final attenuation. It is therefore very important that the brewer should have a simple method for estimating the proportion of dextrin in his worts. The usual method is to titrate with Fehling's solution to obtain the percentage of maltose, then to boil another portion four or five hours with sulphuric acid and again titrated with Fehling to get the percentage of glucose produced from the known amount of maltose and from the dextrin, but this method is of course altogether upset when the worts contain glucose and invert sugars from the use of the various brewing saccharums, unless the percentage of glucose in the wort is known.

The first method that I have employed for the estimation of dextrin in a wort is simply an alcohol method, but it is capable of giving very good results, and is so extremely simple that it is well adapted to the use of brewing pupils.

The gravity of the wort is first taken, and from that the amount of malt extract contained in 100 c.c. can be calculated by dividing the difference of gravity between the wort and water (water = 1,000) by 3·85 (3·85 being the solution weight of malt extract; that is, every 1 per cent. of malt extract contained in solution increases the density ·385 per cent. or 3·85 per thousand).—See Allen's Com., Org. Analysis, Vol. II. 297.

Maltose may be estimated in the usual way by Fehling, and dextrin by precipitation with alcohol as follows:—

Ten c.c. of wort are placed in a small tared beaker and 50 c.c. methylated spirit 60 o.p. added; the greater part of the dextrin will be precipitated, and after a few hours standing will deposit on the bottom of the beaker as a gummy mass, from which the alcoholic liquid can be easily poured off, and the deposit rinsed with a little more alcohol, the beaker is then dried in a water-bath and weighed, to the weight of dextrin so obtained must be added a correction for the quantity retained in solution by the alcoholic liquid—this quantity is ·045 grm. A sample of wort prepared from three-fourths malt and one-fourth germless maize gave the following results.

Sp. gr.	1107·4 = 27·89	per cent. dry extract.
Maltose, by Fehling	21·40	,, ,,
Dextrin	5·19	,, ,,
Albuminoid, mineral matter, &c., by difference	1·30	,, ,,

The second method of examining a malt-wort to be described is one of dialysis. If a solution of sugar be dialysed 24 hours into an equal measure of distilled water, the diffusion will be found to have been *practically* complete, *i.e.*, both the liquids will have the same density and will contain equal amounts of sugar; on the other hand, if a solution of dextrin be dialysed 24 hours into an equal measure of water the diffusate will be found to contain a trace only of dextrin. That being so, it follows that if a malt-wort be dialysed into water the difference in density between the two liquids will be due to dextrin (with a small quantity of albumenoid).

In all cases I prefer to use glass dialysers and a very thin membrane, sold as French gut-skin, which should be fixed by means of an elastic band, the dialysers are five inches in diameter, and are suspended so as just to touch the surface of the water, the object of which is to produce a slight flow of water from the dialysate to the diffusate, so that at the end of the process the volumes can be equalized by pouring from the diffusate into the dialysate, as of course to equalize volumes by pouring from dialysate to diffusate would not be admissible.

In practice I use 100 c.c. of each, and after 24 hours equalize the volumes and take the gravity of each liquid (or a measured quantity of each can be evaporated to dryness). The difference in gravity between the two liquids is due to dextrin, &c., the weight of which can be obtained by calculation as above; an example will make all clear.

A hundred c.c. of the same wort as above were dialysed into 100 c.c. distilled water for 24 hours, at the end of that time the volumes were equalized by pouring a sufficiency of the diffusate into the dialysate and the gravities were taken—

Gravity of dialysate	1065·5
" diffusate	1042·0
Difference due to colloid matter	23·5

which gives 23·5, divided by 3·85 = 6·10 percentage of colloid matter, a result sufficiently close to the previous one to show that fair accuracy can be obtained by this method, which will be found very useful for brewers as no balance is required, a delicate hydrometer being all that is necessary (those sold as urinometers will answer every purpose, and have the advantage of requiring only a small qnantity of liquid to float them).

ON THE DIMINUTION OF THE SOLIDS IN MILK BY DECOMPOSITION.

By Dr. P. Vieth, F.C.S.

Read before the Society of Public Analysts on 15th November, 1882.

At former meetings of this Society Members have spoken several times about analysing samples of milk, which had been kept for weeks and months, and about the loss caused by decomposition. I always was of opinion that it is impossible to mix such a milk thoroughly and take a proper sample for analysis, and that an analysis of such an old and decomposed milk is scarcely of any value. Until some months ago I, however, did not object to taking samples of milk of normal appearance, and keeping exactly measured quantities for analysis for some days in case it was not convenient to analyse them immediately. But experience made me change my opinion.

Samples are taken by the inspectors of the Aylesbury Dairy Company from the Company's own milkmen to control the latter when delivering the milk to the customers. The samples so taken are brought to the laboratory in the forenoon and in the late afternoon, and specific gravity, total solids, and fat are determined. This is done as soon as the samples are brought in, with the only exception that the samples taken for the determination of total solids in the afternoon are not evaporated before the next morning, and, until some months ago, the Saturday's samples not before Monday morning. Of course the samples, contained in small platinum dishes, were kept in a safe place and properly covered.

When the days were getting warmer, the milk kept from Saturday to Monday was generally found to be sour on Monday morning. At the same time it was found that the Saturday afternoon samples always gave a smaller amount of total solids. The diminution was not a very distinct one during the month of May and the early part of June, but from that time became more and more prominent and reached an extraordinary height, when in the beginning of the month of August, on account of the bank holiday, the samples had once stood from Saturday night till Tuesday morning.

To investigate the matter, I at first, on the 4th of July, made the following experiment with evening milk of the previous day, which was brought to London by rail during the night. The milk showed a specific gravity of 1·0324 and amphioteric reaction. I measured nine times 5 cc. of milk into small platinum dishes, put one of the dishes on the steam bath directly, and of the other ones kept four in the laboratory and four in an ice-safe, the temperature of the former place being from 18 to 21° C., of the latter from 10 to 13° C., during the time of the experiment. On each of the following four days two further samples were evaporated, one of those kept at a higher and one kept at a lower temperature. In all cases the solids, after having been weighed, were burnt to ash and the amount of ash ascertained. The results are given in the following table.

Time of keeping	Temperature 10 to 13° C.		Temperature 18 to 21° C.	
	Solids.	Ash.	Solids.	Ash.
—	13·44	·74	—	—
1 day	13·44	·74	13·26	·76
2 days	13·44	·76	13·06	·76
3 ,,	13·18	·76	12·82	·76
4 ,,	13·06	·76	12·78	·76
Diminution after.				
1 day	·00		·18	
2 days	·00		·38	
3 ,,	·26		·62	
4 ,,	·38		·66	

Another series of experiments was commenced on the 15th of August, 1882, with milk from five different farmers. The milk was milked the same day in the morning, and brought to London by rail in the forenoon. The specific gravity varied from 1·0316 to 1·0328, the reaction was amphioteric in all cases. The five milk samples were operated upon in quite the same manner, so that of each milk five times 5 c.c. were taken to ascertain the total solids. One of each series of five samples was put on the steam bath directly, two were kept in the laboratory, and two in the ice-safe. Of the latter samples one of each was dried, and the solids ascertained after two and after four days. The temperature of the laboratory fluctuated at that time from 19 to 21° C., the temperature of the safe was generally between 10 and 12° C., but rose occasionally for a short time to 15° C. In all samples the ash was determined.

The following table gives the results of the experiment :—

Time of keeping—			Two days.				Four days.			
Temperature—			10 to 15° C.		19 to 21° C.		10 to 15° C.		19 to 21° C.	
No.	Solids.	Ash.	Solids.	Ash.	Solids.	Ash.	Solids.	Ash.	Solids.	Ash.
1	12·68	·76	12·26	·76	11·82	·78	11·50	·78	10·38	·76
2	12·70	·76	12·30	·76	11·88	·78	11·86	·76	11·18	·76
3	12·52	·76	12·26	·76	11·68	·78	11·60	·76	10·48	·76
4	13·12	·72	13·00	·72	12·32	·74	12·06	·72	10·46	·74
5	13·08	·74	12·78	·74	12·52	·74	12·08	·74	12·00	·76
Average	12·82	·75	12·52	·75	12·04	·76	11·82	·75	10·90	·76
Diminution of Solids.										
1			·42		·86		1·18		2·30	
2			·40		·82		·84		1·52	
3			·26		·84		·92		2·04	
4			·12		·80		1·06		2·66	
5			·30		·56		1·00		1·08	
Average			·30		·78		1·00		1·92	

Both series of experiments show very distinctly that the solids of milk are diminished to a considerable extent by decomposition of the milk. The diminution becomes more extensive with the length of time, and is limited if the milk is kept under conditions unfavourable to speedily progressing decomposition. In the first series there was, after two days, no diminution at all in those samples which had been kept in the safe. In the second series the diminution in the corresponding samples was, on the whole, very equal. If in comparison therewith the diminution in the first series after two and four days was very much less, it would be easy to find some causes for that. I only mention the possible and very probable difference in the temperature of the air, and further the circumstance that for the first series there was evening milk used, which was brought to London during the cool time of night, but for the second series morning milk, brought here during the warmer hours of the forenoon.

Regarding the diminution itself, we saw that it appears at the same time when the milk turns sour—that is, when the sugar is decomposed by lactic fermentation and lactic acid formed. But as the milk sugar thereby is merely split up, this decomposition does not involve any loss, and therefore cannot account for the diminution of the solids. So we have to look out for other changes, and would think in the first place of alcoholic fermentation, which again concerns the sugar; whether and how far the other component parts of the milk take part in its decomposition remains to be ascertained.

The experiments just communicated certainly show that the determination of the solids in sour milk, even in case the same should be only a few days old, sometimes may give results quite different from those which would be arrived at if the milk had been analysed in a fresh state.

ERRATA.

Dr. Tucker requests us to make the following corrections in the abstract of his Report, reprinted from the *Sanitary Engineer*. His letter arrived too late for the corrections to be made before the reprint appeared :—

Page 197, line 30 from top, for "bi-carbonate of soda," read "*carbonate of soda*."
,, ,, ,, 12 from bottom, for "hydro soda," read "*hydro sodic*."
,, 198, ,, 20 from top, for "potassic bi-carbonate," read "*potassic citrate*."
,, ,, ,, 21 (at end), for "carbonic acid," read "*tartaric acid*."

SOCIETY OF PUBLIC ANALYSTS.

Analyses of English Public Water Supplies in November, 1882. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Date when drawn.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine in Chlorides.	Phosphoric Acid in Phosphates.	Nitrogen in Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in		Hardness, Clark's Scale, in degrees.		Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
									15 mins. at 80° Fahr.	4 hours at 80° Fahr.	Before Boiling.	After Boiling.			
Kent Co.	Nov. 16	c. blue	none	1·70	none	·33	·0025	·0028	·004	·022	21·0°	7·0°	34·4		Wigner & Harland.
New River	,,	clear yell.	none	1·12	trace	·18	·0007	·0031	·032	·084	15·5°	4·5°	22·1	satisfactory	B. Dyer.
East London ..	,, 16	c. yell. green	none	1·20	none	·13	·0018	·0049	·046	·082	16·0°	3·5°	26·8	veg. deb., myclm. animle.	Wigner & Harland.
Southwark & Vauxhall ..	,, 13	yellowish	none	1·15	trace	·11	·0014	·0120	·091	·147	15·0°	4·0°	22·4	veg. debris, &c.	John Muter.
West Middlesex	,, 27	green. yell.	none	·98	trace	·10	·0010	·0060	·063	·116	11·5°	3·5°	21·8	satisfactory	O. Hehner.
Grand Junction	,,	greenish yell.	none	1·24	trace	·18	·0016	·0061	·023	·074	14·4°	4·0°	21·2		A. Wynter-Blyth.
Lambeth	,, 13	yellowish	none	1·20	trace	·12	·0014	·0112	·092	·128	15·5°	4·0°	22·2	veg. debris, &c.	John Muter.
Chelsea	,, 21	yell. green	none	1·54	trace	·18	none	·0062	·064	·156	14·5°	4·5°	21·0	satisfactory	A. Dupré.
Birmingham ..	,, 2	greenish yell.	none	1·14	trace	·20	·0035		·051	·130	10·5°	7·4°	16·7		A. Hill.
Brighton	,, 9	c. pale blue	none	2·55	none	·30	·0025	·0022	·018	·024	13·0°	4·0°	24·8	animal hair, veg. fibre	Wigner & Harland.
Bristol	,, 6	brn. green	none	·90	none	·04	none	·0030	·007	·015	15·2°	1·8°	24·3	algæ sand	F. W. Stoddart.
Cambridge	,, 20	c. p. blue	none	1·40	trace	·38	none	·0007	none	·046	17·5°	5·0°	25·0	satisfactory	J. West Knights.
Croydon	,, 21	f. bluish green	none	1·26	none	none	·0050	·0040	·008	·011	16·0°	6·0°	23·6	satisfactory	C. Heisch.
Edinburgh	,, 27	s. brown	none	·96	trace	trace	trace	·0080	·016	·136	4·2°	3·9°	5·2	satisfactory	J. Falconer King.
Exeter	,, 16	f. b. yellow	none	·84	trace	·27	·0014	·0034	·021	·034	2·8°	2·8°	6·3	satisfactory	F. P. Perkins.
Hereford	,, 6	clear colourless	none	·30	none	none	·0002	·0005	·001	·007	4·1°	2·0°	3·7	satisfactory	G. J. Stephens.

SOCIETY OF PUBLIC ANALYSTS.

Analyses of English Public Water Supplies in November, 1882. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Date when drawn.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine in Chlorides.	Phosphoric Acid in Phosphates.	Nitrogen in Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in		Hardness, Clark's Scale, in degrees.		Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
									15 mins. at 80° Fahr.	4 hours at 80° Fahr.	Before Boiling.	After Boiling.			
Liverpool	Nov. 27	grnsh. brown	s. peaty	·95	trace	·038	·0014	·0084	·022	·078	4·7°	3·3°	7·5		A. Smetham.
Maidstone—															
Wtr. Company	„ 22	c. yell. green	none	2·30	trace	·62	·0014	·0021	·036	·078	18·0°	6·0°	34·5	none	M. A. Adams.
Public Conduit	„ 22	p. green blue	none	2·20	trace	·60	none	·0014	·036	·072	17·5°	7·0°	33·7	none	M. A. Adams.
Manchester....	„ 18	s. turb. f. yell.	none	·73	none	none	·0034	·0051	·067	·135	1·7°	1·7°	5·3	satisfactory	W. Thomson.
Northwich	„ 18	yell. green	none	3·50	h. trace	·39	·0004	·0016	·036	·131	11·0°	8·0°	15·0	dtms., mvg. org. veg. deb.	C. M. Blades.
Norwich	„ 12	p. grnsh. yell.	v. slight	1·70	trace	·08	trace	·0132	·087	·173	12·0°	5·2°	16·8		W. G. Crook.
Nottingham ..	„ 17	c. grnsh.	none	1·56	none	.77	none	trace	·008	·046	12·0°	8·0°	23·0	veg. deb., myclm. animl.	Wigner & Harland.
Rugby	„ 9	turbid peaty		1·20	h. trace	·10	·0040	·0100	·016	·029	12·0°	6·5°	18·4	veg. deb. animal.	A. P. Smith.
Salford	„ 21	yellow	none	·65	none	none	·0010	·0010	·017	·067	3·0°	2·5°	4·5	satisfactory	J. Carter Bell.
Worcester	„ 10	p. yellow	none	1·30	trace	·24	none	·0090	·025	·150	11·5°	6·2°	15·5	veg. debris	W. E. Porter.

Abbreviations:—c., clear; f., faint; h., heavy; p., pale; v. h., very heavy; v. s., very slight.

Errata.—Birmingham Water, October, Nitrates should be ·0693 instead of ·693.
„ Oxygen absorbed in 15 minutes „ ·0091 „ ·091.
„ „ „ 4 hours „ ·0245 „ ·245.

REPORT OF THE LOCAL GOVERNMENT BOARD.

We take the following from the Blue Book recently published :—

It will have been observed from our previous Reports that the Authority for each County in England and Wales and the several Vestries and District Boards of Works in the Metropolis had complied with the provisions of this important Statute as regards the appointment of Analysts. It will also be seen from our last Report that up to the 31st of December 1880, the total number of appointments made by Municipal Corporations was 156, and that we were then in correspondence with the Authorities who had not appointed an Analyst. The result has been that during the year ended on the 31st of December last some additional appointments were made, and, on that date, the total number of Districts in which Analysts were acting was 260. We shall not fail to urge upon those Authorities who, so far, have omitted to comply with the provisions of the Act in this respect, the importance and expediency of making suitable appointments.

A question has recently arisen as to whether a Town Council who have entered into an Agreement, pursuant to section 14 of the 3 & 4 Vict., c. 88, with the County Authority for the Watching of the Borough should appoint an Analyst. The Board have been advised that Boroughs in which such an arrangement exists must be held to come within the terms of section 10, paragraph 1, of the Statute 38 & 39 Vict., c. 63, and, consequently, that it devolves upon the Town Councils of such Boroughs either to appoint an Analyst pursuant to that section or to make an arrangement for analyses such as is contemplated by section 11.

The result of the analyses made during the year is shown in the abstract printed in the Appendix. It will be seen that the total number of such analyses is 17,823, or about 150 more than in 1880. Of these, 5,039, or not far short of one third, were made in the Metropolis, this number being, by a curious coincidence, exactly the same as in 1880. As the public continue to avail themselves only to a very small extent of the provisions of the Act, its operation depends principally upon the extent to which local authorities choose to exercise their power of procuring samples for analysis ; and the result is that while in some districts the Act is well enforced, in others it is almost a dead letter. We suggested in our last report that at least one sample should be analysed yearly for every thousand persons throughout the country, but we find that, outside the Metropolis, this proportion has been attained only in the districts of three County Authorities, and in 29 boroughs. Within the jurisdiction of the magistrates of the 12 counties of Berks, Bucks, Cambridge, Cornwall, Dorset, Hertford, Monmouth, Northumberland, Rutland, Salop, Suffolk, and Wilts, only about 50 samples in all were analysed, and from 66 boroughs the return is absolutely *nil*, while in many others the number of analyses is quite insignificant. We have in these cases endeavoured to induce the Authorities to take action, but we cannot congratulate ourselves on the success of our attempts in this direction. The Town Councils of the smaller boroughs, especially, seem generally very unwilling to entertain a suspicion that the articles sold in their districts may possibly be adulterated ; and, though we have taken care to point out that the Act is designed not only to protect the public, but also to prevent honest tradesmen from being undersold by unscrupulous competitors, we have, in most cases, failed to persuade this class of Authorities to have samples analysed.

In one case indeed a Town Council had at first refused to have samples analysed, giving as a reason that they had received no complaints of adulteration, but afterwards on

our insistance decided to make the experiment. The result was that no less than three out of four of the samples examined in the third quarter for 1881 were found adulterated.

Even in some towns of considerable population we have found the same indisposition on the part of the Authorities to exercise the powers entrusted to them. On the other hand the returns show that in many districts the Act is being efficiently administered with results that are unquestionably satisfactory.

It seems desirable to call attention to the necessity for more caution than has been exhibited in some instances as regards the purchase of articles for analysis. Inspectors of Weights and Measures, Inspector of Nuisances, and other persons, who remain in office year after year, are apt to get too well known to the tradesmen to have much chance of being served with the same class of goods that are sold to the general public. Even the police, unless they take exceptional precautions, are not unlikely to be recognised by the keen eye of the adulterating tradesman. The analyst for Southampton gives a good illustration of this. He says that after the Inspectors had visited one or two shops they found, to use their own words, that "the game was up." They were known, and neighbouring tradesmen were put on the alert; on asking for coffee or butter they were informed that the shopkeepers did not keep pure coffee or butter, and could only sell such as they had as a mixture. In one case when coffee was asked for, the shopkeeper ordered his assistant to weigh out two ounces of berries and pound them in a wooden mortar, while a person was despatched to give information elsewhere. The analyst adds that on the evening of the same day he sent to the shop in question for coffee, and his messenger was served with a mixture largely adulterated with chicory. And when one of the inspectors employed a boy to make the purchases on his behalf, out of 13 samples of coffee sold, 10 were adulterated with chicory, though in all cases "coffee" was asked for. The attention of inspectors acting under the 13th section of the Sale of Food and Drugs Act should be specially called to the fact that they may employ a deputy to buy articles for analysis, and may take proceedings against the seller if such articles are found adulterated. (See Horder v. Scott, L. R. 5, Q.B.D. 552.)

The following table shows the number of samples examined during the year and the percentage of cases in which adulteration was reported to exist:—

——	Examined.	Adulterated.	1880. Percentage of Adulteration.	1881. Percentage of Adulteration.
Milk	6,926	1,356	21·4	19·5
Bread	1,037	49	6·4	4·7
Flour	429	—	1·0	—
Butter	1,353	188	18·3	13·9
Coffee	1,224	224	19·2	18·3
Mustard	864	123	15·8	14·2
Pickles (including Tinned Vegetables)	34	2	2·2	5·8
Sugar	284	1	—	0·3
Jam	46	3	6·9	6·5
Confectionery	213	2	—	0·9
Wine	38	2	19·4	5·2
Beer	326	8	4·1	2·4
Gin	648	168	20·1	25·9
Spirits other than Gin	1,150	327	25·9	28·4
Drugs	398	60	15·5	15·0
Other Articles	2, 53	100	3·0	3·5
Totals	17,823	2,613	15·68	14·67

It will be seen from this table that the proportion of adulterated samples has fallen to 14·7 per cent. of those examined, and we are glad to state that a comparison of this percentage with those of previous years, seems to indicate that adulteration, so far as its prevalence can be judged of from these returns, is pretty steadily diminishing. The results of the five years during which the returns have been made in such a form as to admit of tabulation on a uniform plan, stand as follows:—

	Samples Analysed.	Adulterated.	Percentage of Adulteration.
1877	14,706	2,826	19·2
1878	16,191	2,782	17·2
1879	17,049	2,535	14·8
1880	17,673	2,772	15·7
1881	17,823	2,613	14·7

It is noteworthy that in the Metropolis the percentage is only 12·4, which seems to show that London is much better off than the rest of the kingdom as regards the purity of its food.

More than a third of the samples analysed, and more than half of those reported against, were of milk. Some improvements in the purity of this article seems to have been effected by the Act, as the proportion of adulterated samples, which in the whole of England and Wales was 24·1 per cent. in 1877, was only 19·5 per cent. in 1881. In the Metropolis the percentage of samples reported against was 23·4; and this proportion, formidably large as it is, nevertheless compares very favourably with that recorded in previous years.

In some of the London districts the proportion of samples of milk returned as adulterated is enormous. For instance in the City of London itself no less than 30 samples out of 71 were reported against, in St. Pancras, 34 out of 87, and in Woolwich, 31 out of 46. On the other hand, in St. James's, Westminster, all the 60 samples examined were pronounced genuine, in Lambeth only 13 samples were found adulterated out of 143, and in Wandsworth only 11 out of 119. We confess that we have some doubt whether the relative prevalence of adulteration is accurately represented by these figures, or whether differences in the administration of the Act may not have something to do with these remarkable contrasts. As the area of distribution of particular milk supplies does not, as a rule, follow the boundaries of sanitary districts, it is difficult to know why, for instance, the district of St. James, Westminster, should, according to the returns, be invariably supplied with pure milk, while adulteration is reported in numerous instances from neighbouring districts.

Of the eight most populous provincial towns we find that Birmingham has 32 adulterated samples of milk out of 59 analysed; Manchester 39 out of 162; Salford 106 out of 457; Bristol 44 out of 195; Liverpool 44 out of 199; Leeds 6 out of 33; Bradford 11 out of 74; and Sheffield 7 out of 64.

Birmingham, therefore, still maintains the distinction which it has for some years enjoyed of having a larger proportion of its milk reported as adulterated than any other great town in the kingdom.

As regards the analysis of milk we regret to say that a difficulty to which we have referred in previous reports crops up from time to time with the effect of apparently discrediting the machinery of the Sale of Food and Drugs Act. It has happened in more than one instance that an analyst has found a sample to be about equal to average milk to which 25 per cent. of water had been added, and (after leaving an apparently ample margin for possible natural poverty) he has had no hesitation, from the results of his analysis, in reporting it to be adulterated. Then the dairyman has challenged the accuracy of the analysis, and has produced a cow which, when milked in presence of the inspector, has given milk of no better quality than that reported against. It is true that the milk in question has, perhaps, contained little more than half the nutriment which good milk affords (in one case a sample was found with only 8 per cent. of solids and 92 per cent. of water), but still, in consequence of its being undoubtedly the genuine product of the cow, the magistrates have felt a difficulty in convicting the seller. In one instance of this kind the Authority brought the facts specially under our notice, and expressed a disinclination to have any more milk dealt with under the Act. We advised, however, that in a case of such abnormal poverty of milk the analyst was not to blame, in the present state of science, for reporting against it. We pointed out that the case was a very proper one for such investigation as proceedings before a magistrate would afford, so that inquiry might be made into all the circumstances, and the magistrate might determine whether an offence under the Act had been committed by the sale, as milk, of an article not of the "substance and quality" of that usually sold under the name. The analyst, in judging of milk, must necessarily adopt a minimum standard of constituents, based on a large number of analyses of genuine milk. But there would be great difficulty in prescribing a standard by Act of Parliament, as has been occasionally suggested, for if it were fixed so low as to class as genuine the milk of the oldest and worst fed cows to be found in the country, it would admit of the addition of an enormous amount of water to milk of fair quality; if, on the other hand, the standard of a fair average milk were adopted, there would be a loud outcry against the prohibition to sell genuine milk falling below that average. It is much to be wished that science should devise some mode of distinguishing milk to which water has been added from that which contains only its natural constituents, for until this can be achieved we fear that the analysis of milk cannot be placed on an entirely satisfactory footing, so far, at any rate, as border cases are concerned.

The amount of water added is often very large, and in a few instances reaches the enormous proportion of 60 or 70 per cent. Probably 20 per cent. may be taken as about the average. The analyst for Woolwich, however, in reporting upon a number of samples as diluted to about this extent, remarks that according to experience the inspectors are not generally successful in procuring the worst specimens, and he suggests that the inhabitants of that parish must be paying some thousands of pounds a year under the name of milkmen's bills, but really as an additional water-rate. The analyst for Essex complains that the milk is not even adulterated with pure water, and suggests that the compound is "eminently favourable for the propagation and development of disease germs." He adds that this view is confirmed by the fact that in nearly every case he has observed that a diluted milk decomposes and putrefies much more rapidly than that which is genuine.

Complaint has been made of the smallness of the fines inflicted in some rather flagrant instances of milk adulteration. No doubt this particular form of fraud is as remunerative

as it is simple; and a dairyman who adds 20 per cent. to his legitimate profits by having recourse to the pump is not to be deterred by an occasional penalty of ten shillings or a pound. Of course the fact that legal proceedings against him have been successful tends to lessen his custom, but on the other hand, it is possible that a large proportion of his customers may never hear of the conviction.

We should be glad to see more extensive use of the provision of the Act of 1879, which allows the taking of samples from milk cans at railway stations before delivery to the retailers. The plan has been adopted in two or three districts with very satisfactory results, and not only checks adulteration near its source, but protects the characters of honest traders, who do not water the milk, and who may have no suspicion that they are themselves being cheated.

The adulteration of bread seems to be steadily on the decrease. Less than 5 per cent. of the samples examined were found impure. In these cases the adulteration consisted for the most part of additions of alum introduced in order to improve the appearance of the bread, but having the effect, when present in quantity, of making it very indigestible. A curious point arose in Essex, when proceedings were taken as to a sample of bread reported as adulterated with alum; for the case was dismissed, according to the analyst's statement, because the inspector, having bought two loaves, left one of them with the vendor, and sent a portion of the other to be analysed. The court held that a portion of the actual loaf analysed must be left with the seller, and so the prosecution fell through.

It is noticeable that of more than 400 samples of flour analysed not a single one was found adulterated.

In the matter of butter the returns show a marked improvement, the percentage of adulteration having dropped from 18 in 1880, to 14 in 1881. It is possible that the recognition of butterine as a wholesome article of diet and a cheap substitute has led to its being sold to a greater extent under its proper name instead of under that of butter. In some cases the ingenuity of dairymen seems to be directed to the introduction of as much water as possible into butter during the process of manufacture. The analyst for Southampton remarks on one such sample, containing no less than 19 per cent. of water, that water is rather dear at the price of 1*s*. 4*d*. a pound, being after the rate of 3*s*. 4*d*. per quart.

In coffee the proportion of adulteration is rather less than last year. It continues to consist principally of chicory. In fact the habit of selling a mixture of chicory and coffee when coffee is asked for, sometimes with, but oftener without, a label notifying the fact of admixture, has unfortunately become an apparently ineradicable custom of the trade. Sometimes a specious title such as "French coffee" is given to the mixture, and in these cases it is generally found that the proportion of chicory is exceptionally large, amounting sometimes to 60 or 70 per cent.

The so-called adulteration of mustard with flour and turmeric continues to take place rather probably for the convenience, than for the deception, of people who desire, not merely mustard seed, but a preparation of mustard for table. Moreover, it seems to be admitted that pure mustard cannot without difficulty be kept good for any length of time.

The adulteration of sugar is practically a thing of the past, and we are glad to say that the very dangerous practice of using poisonous pigments for colouring confectionery, a practice which used to be very general in the early days of analyses, seems also to have been almost entirely abandoned.

Eight samples of beer were reported against out of 326 analysed. Excess of salt was in most of these cases the cause of their condemnation. In Bolton a material known as "beer heading," and chiefly composed of liquorice, aloes, and capsicum, was submitted for analysis, but this substance does not seem to have been met with in beer itself.

It is somewhat disappointing to find that spirits still figure prominently in the enumeration of adulterated samples, as more than a quarter of those examined were reported against. It was anticipated by the framers of the Act of 1879, that the very low standards fixed by that Act would practically be attained by all spirits usually sold. But though the adulteration is nothing but dilution, it is found that water is added in many instances with extraordinary profusion, and a good deal of gin is sold containing not much more than 20 per cent. of alcohol.

The number of samples of drugs reported upon is still much smaller than in our opinion is desirable, and the percentage of adulteration continues very large.

Among the articles not specially enumerated in the table above was a sample of cayenne pepper adulterated with red lead. This form of adulteration, which is very dangerous to health, used to be popular, but has of late years apparently died out, and we trust that it will not be revived. A large number of samples were of cocoa, and this article seems, as a rule, to be less adulterated than formerly. In the pure cocoa-bean, with merely the fat extracted, there is a large amount of nutriment. But in some of the common preparations as much as 80 per cent. of the bulk is found to be made up of arrowroot and sugar, and a cup of cocoa made from this composition is almost valueless as diet. In Paddington the Sanitary Committee, in consequence of the general alarm as to the condition of bacon, caused a number of samples of the cheapest and lowest quality to be submitted for analysis. In no case, however, were any trichinæ discovered. Some German sausages were also examined, and were found free from any parasitic or other noxious substances. They were composed of about half bread, nearly one quarter of fat, nearly one quarter of bull beef, with a little pepper, salt, and some herbs.

Of the 17,823 samples analysed during the year, all but 358 were obtained by officers of local authorities. A much larger proportion of the private than of the public purchases were found adulterated; this being doubtless due, for the most part, to the fact that a private purchaser is not likely to take the trouble, and incur the expense of analysis, unless he is tolerably confident that the goods sold to him are adulterated. Besides, as we have said above, there is good ground for believing that in some cases the inspectors are served with better articles than the general public.

Probably the cost of analyses often tends to prevent the public from more largely availing themselves of the Act. Bristol, Salford, and some other boroughs have, we think, done wisely in making arrangements with the analyst to analyse samples at 2s. 6d. each, instead of the half-guinea, mentioned in the Act as a maximum fee. In both the towns named the proportion of samples submitted for analysis by private purchasers is exceptionally large.

Two important decisions of the High Court of Justice have been given during the year with reference to the Sale of Food and Drugs' Act. In the case of Stare v. Smith (45 J. P. 141.) it was held that where an article is purchased by an assistant acting on behalf of an inspector appointed under section 13 of the Act of 1875, it is not necessary that subsequent

TOTAL NUMBER OF SAMPLES.

	Examined.	Adulterated.	Proportion Adulterated. 1881.	1882.
The Metropolitan District	5069	629	12·4	14·5
COUNTIES.				
Bedford	297	25	8·4	7·0
Berks	72	7	9·7	15·4
Bucks	12	5	41·6	—
Cambridge	54	3	5·5	12·9
Chester	663	129	19·4	19·6
Cornwall	3	1	33·3	68·6
Cumberland	119	23	19·3	10·4
Derby	118	26	22·0	28·8
Devon	122	30	24·5	22·2
Dorset	9	5	55·5	56·2
Durham	591	118	19·9	22·3
Essex	352	50	14·2	8·9
Gloucester	725	60	8·2	7·0
Hereford	30	0	—	—
Herts	—	—	—	—
Hunts	29	5	17·2	72·2
Kent	150	28	18·6	21·3
Lancaster	2269	422	18·5	17·5
Leicester	298	32	10·7	12·4
Lincoln	429	49	11·4	10·6
Middlesex	215	47	21·8	16·2
Monmouth	58	3	5·1	27·4
Norfolk	135	19	14·0	31·6
Northampton	89	12	13·4	12·0
Northumberland	121	18	14·8	17·1
Nottingham	88	14	15·9	20·4
Oxford	163	28	17·1	40·0
Rutland	—	—	—	20·0
Shropshire	6	0	—	15·4
Somerset	1052	65	6·1	5·5
Southampton	528	101	19·1	17·0
Stafford	1001	124	12·3	16·1
Suffolk	7	2	28·5	50·0
Surrey	504	96	19·0	21·0
Sussex	373	49	13·1	16·8
Warwick	448	116	25·8	25·7
Westmoreland	9	1	11·1	18·7
Wilts	43	9	20·9	7·4
Worcester	151	17	11·2	14·2
York, E. Riding	71	13	18·3	18·0
,, N. Riding	31	3	9·6	20·0
,, W. Riding	667	108	16·1	17·1
WALES.				
Anglesey	15	4	26·6	33·3
Brecknock	11	5	45·4	30·4
Cardigan	20	9	45·0	30·7
Carmarthen	15	2	13·3	11·1
Carnarvon	9	3	33·3	66·6
Denbigh	8	2	25·0	22·2
Flint	32	13	40·6	45·0
Glamorgan	473	40	—	7·7
Merioneth	59	33	55·9	7·6
Montgomery	3	0	—	—
Pembroke	25	7	28·0	31·2
Radnor	12	3	25·0	33·3
TOTALS	17,823	2,618	14·67	[illegible]

legal proceedings on account of adulteration should be taken by such assistant, but that the inspector is to be regarded as the actual purchaser, and as such entitled to institute the proceedings. In the case of Harrison v. Richards (45 J. P. 552), a summons had been taken out in a Metropolitan Police Court against a dairyman for selling milk, which, according to the analyst's certificate, was adulterated with 20 per cent. of water. The dairyman did not tender any evidence at the hearing, nor was the analyst examined; but the magistrate dismissed the case on the ground that he was not satisfied that the milk had been adulterated, and believed that its exceptional thinness was due to accidental circumstances. The High Court, however, held on appeal that, as the conditions prescribed in section 21 of the Act with regard to the examination of the analyst and of the defendant had not been complied with, the magistrate was not justified in going behind the analyst's certificate, and his decision was therefore erroneous in point of law.

REVIEW.

Practical Chemistry, Analytical Tables, and Exercises for Students (Second Edition).

By J. Campbell Brown, D.Sc.

London: J. & A. Churchill, New Burlington Street.

This is another addition to the voluminous literature on Qualitative Analysis, but we feel sure it is a volume that will meet with approbation, not only on account of the carefully compiled tables for the "Systematic Examination" for bases and acids, but also for the *special information* given, that is omitted in most works upon this subject. We may mention the following tables: "Organic Acids;" "Table for the Separation of Organic Bases;" "Tests for the Principal Organic Bases;" "Table for Analyses of Gases." The reducing power of various sugars upon Fehling's Solution, and their specific rotatory power upon polarized light, is also given. It is a work that requires the student to possess more than a mere "class" knowledge of the subject, for its pages are few, and, therefore, all minor details are necessarily omitted.

PHARMACEUTICAL SOCIETY OF GREAT BRITAIN *v.* JAMES KELSALL.

This case was tried at the County Court at Stockport, on the 10th inst., before T. Hughes, Esq., Q.C., Judge.

Mr. Yates, instructed by Messrs. Flux, Son and Co., appeared for the plaintiffs, and Mr. Brown (Brown and Ainsworth) appeared for the defendant.

This was an action brought by the Pharmaceutical Society of Great Britain to recover from the defendant, James Kelsall, a penalty of £5 for an infringement of the Pharmacy Act passed in 1868. By a section of that Act it is enacted that from and after the 31st of December, 1868, any person who shall take, use or exhibit the name or title "chemist and druggist," or "chemist" or "druggist," not being a duly registered "pharmaceutical chemist" or "chemist and druggist," shall, for every such offence, be liable to a penalty of £5 to be recovered in the way prescribed by the Pharmacy Act. The circumstances of the case are these:—The defendant had a shop in Sandy Lane, Stockport, and over the door he had a notice "Kelsall, Analytical Chemist." He also had numerous handbills published, in which there was the heading "James Kelsall, Analytical Chemist." The defendant, having the words over his shop, was written to by the Society, and replied that when he used and exhibited the title of "analytical chemist," he was not infringing the Act of Parliament.

After evidence had been given, his Honour said: This, I must say, is a very unfortunate case for the defendant, and to the public it is a very important case. The defendant appears to be a person who has served his country in foreign parts and to have been wounded there, and everyone must feel the greatest sympathy for him. From his experience in South Africa it is said that he is considerably skilled in the healing of wounds, and it is also said that he is a competent analyst. Of course I am not prepared to say that he is not thoroughly competent, from his experience in South Africa, both to deal with wounds, &c., such as those he states in his prospectus, and also to sell drugs. You see that I have this bill before me. One of the contentions is that he is not a pharmaceutical chemist. I have here before me his own bill, which says that "James Kelsall, Analytical Chemist, late Surgeon's Assistant, Government Hospital, South Africa, cures burns, scalds, ulcers, bruises, &c., &c., at the little hospital in Sandy Lane." In fact he names nearly all the ills to which flesh is subject, and, therefore, there must be dressings and medicines. Now the case on behalf of the defendant has been opened as a very hard one for him, and certainly in one sense it was very hard that everyone should not be able to exercise every faculty they may possess for their own good; but for the protection of society the British Legislature has enacted that which has for its object the protection of the British public from those practitioners in the country who are not fully competent. Now, if the defendant is fully competent he has only to go through the ordinary course of obtaining power to deal as he wishes to deal with these drugs and other medicines. But now comes the question which really has to be settled, and which I must decide. The merits of the case I have thoroughly followed. I wish to state that I have respect for a man who has personally suffered in the service of his country, but then comes the legal question to be decided. This person puts himself forward as an "analytical chemist." He knows thoroughly well what he is about, for as early as August he was reminded by the Pharmaceutical Society that he had no right to the employment of the term "chemist." And what did he say in reply? He said that he did not use it in any sense which would bring him within the meaning of the Legislature in passing the Pharmacy Acts, and his argument has been an argument which has been well put before the court by Mr. Brown. He does not say that he is a chemist at all, because he says he is an "analytical chemist." It seems to me that, having regard to the meaning of the word "chemist," one might as well contend with regard to a man that he was not a man because he is a warm-blooded man. I think that is a contention which cannot be sustained at all. And what is the consequence? Mr. Brown, in his speech, has called attention to the fact that the Act should be strictly construed. I think that in the case of any such person as this, who uses or exhibits the name or title of chemist and druggist, or chemist or druggist, not being a duly registered pharmaceutical chemist or chemist and druggist,—it seems to me that it is impossible on the strictest construction of the terms of the section,—it is impossible to say that a person who publishes himself as an analytical chemist does not come within the meaning of the Act. I think that in this case the defendant has distinctly and clearly infringed the terms of the Act. The case seems precisely to be one of those which the Act is intended to meet, and to be applied to. Defendant has incurred the penalty, and judgment must be for the plaintiffs. Judgment for the plaintiffs for £5 penalty, and £5 12s. costs.

LAW REPORTS.

Adulterated Vinegar:—

Messrs. Cole & French, grocers, of High Street, Guildford, were summoned before the Borough Bench recently, for selling a pint of vinegar, on the 18th October, which was not of the nature, quality, and substance demanded by the purchaser. Police-constable Hall proved the purchase; he paid 3d. for the vinegar, which he afterwards handed to the superintendent. Mr. Superintendent Law said he received a pint of vinegar from the last witness, and afterwards handed a portion to the Borough Analyst. The analyst's certificate was produced, and stated that the vinegar contained 25 per cent. more water than it should do. Mr. Cole (one of the defendants) produced a letter from the makers of the vinegar, Messrs. Hills & Underwood, who stated that it was genuine when sent away, and it must have been seriously tampered with in transit by the addition of water. Mr. George Durbidge said he was instructed to watch the case on behalf of Messrs. Hill & Underwood. They had told him that all their vinegar was kept in one huge vat, and the whole of it was sent from that vat. Other casks had been supplied to the defendants from the same vat, and found to be genuine. The Bench said the case had been proved, so far as the defendants were concerned, and they would be fined £1 and 13s. costs.

Rain Water and Milk:—

At Lambeth, John Wilkinson, shopkeeper, of 63, Albany Road, Camberwell, was summoned by Inspector Fisher, on behalf of the Camberwell Vestry, for selling milk in an adulterated condition. The inspector proved that some milk purchased at the defendant's shop was submitted to the analyst, and found to be adulterated to the extent of 30 per cent. with added water. The defendant said the milk was left outside the house early in the morning, and at that time the rain was coming down heavily. Mr. Saunders asked the defendant if he had allowed the churn to remain in such a position on purpose, and he said he certainly had not. Mr. Saunders supposed the defendant wanted him to believe the rain-water had adulterated the milk to the extent of 30 per cent. He could not come to such a conclusion, and ordered the defendant to pay a fine of 40s. and 12s. costs.

Coffee and Chicory:—

At Swindon Police Court, Nov.16th, the magistrates decided a case—several times adjourned—in which Mr. J. J. Cleverley, grocer, of Prospect Place, Swindon, was charged with selling Supt. North a tin of coffee adulterated to the extent of 80 per cent with chicory. Mr. J. C. Townsend appeared for the defendant. Superintendent North proved going to the defendant's shop and asking for a quarter of a pound of tinned coffee, which he said he wanted for analysis. The defendant gave him a tin of Cassell's coffee, pointing out that it was labelled "Coffee mixed with chicory." Witness told him that he did not think that would save him, and that he should send it to the Public Analyst to have it analysed. The defendant said he had no fear of that, and stated that he did not care to keep a sample. He initialed the label on the tin, which the witness produced. Witness forwarded the tin the same day to W. F. Donkin, St. George's Hospital, London, for analysis; and on September 27th he received a certificate of analysis stating that the tin contained coffee 20 per cent., chicory 80 per cent. On that certificate he took these proceedings. In cross-examination, the witness said he had no particular instructions to go to the defendant's shop. He dealt with him, and believed him to be a respectable tradesman. Other tradesmen sold similar coffee before this but not now. He paid at the rate of 1s. 8d. per lb. for the coffee; the price of best coffee was 2s. per lb. A portion of the coffee obtained from Mr. Cleverley had been sent to the analyst of the Inland Revenue. Mr. W. Foote (magistrate's clerk) proved sending a sample of coffee handed to him by Superintendant North to the authorities of the Inland Revenue, and requested them to make an analysis. A certificate had been received from the commissioners to the effect that it contained 45 per cent. of chicory, leaving 55 of coffee. This certificate was signed by three officials of the Inland Revenue Laboratory. It was mentioned that a second analysis had been received from Mr. Donkin, who now said that the exact proportions were 38 per cent. of coffee and 62 of chicory. Mr. Townsend stated that the manufacturer had informed him that the mixture really consisted of 60 per cent. of the finest coffee and 40 per cent. of the finest chicory, which, they contended, was a perfectly fair proportion, taking into consideration the fine qualities of both the coffee and chicory they used and the expense of putting it up in such small tins. Mr. Townsend said that Mr. Cleverley thought his character was affected, and had a sample of the mixture analysed by Mr. Redwood, of the Pharmaceutical Society of Great Britain, and Public Analyst of Middlesex, and considered to be the first analyst in England; and he certified that it contained thirty-eight parts of chicory in one hundred. Mr. Townsend said he did not rely upon the certificate, but it showed how analysts differed. Before they went into the case, was it necessary to decide upon Superintendent North's evidence if there was any case against Mr. Cleverley? In order to convict Mr. Cleverley they would have to rule that there was no protection in the label. The judges held that if before sale the vendor called the attention of the purchaser that it was an admixture, he was not called upon to tell the purchaser the proportion of the ingredients, and that was sufficient protection. Superintendent North's attention having been called to the fact that it was an admixture, he thought there was no case against Mr. Cleverley. Before they could convict it would be necessary to show that the adulteration was so great that it would be fraudulent for the price charged; for, as Mr. Justice Lush had said, he did not see that it was fraudulent, seeing that the purchaser knew it was there. Mr. Townsend quoted several cases that had been decided by the judges, and said if those cases were binding, the magistrates would have no alternative. In answer to inquiries by the magistrates, Superintendent North said that he first stated that he required the coffee for analysis, and that Mr. Cleverley, if he refused him a sample, would be liable to a forfeit of £10. Mr. Townsend proceeded to read extracts from the law reports, showing that there was no offence if the chicory was not in such quantity as to fraudulently increase the bulk. The shopkeeper, if he knew the relative ingredients, might be as liable as the manufacturers. But he should prove that Mr. Cleverley did not know what were the relative ingredients, and he did no suppose either of the magistrates would say he did. The defendant was then called and examined.

He said he sold coffee at 2s. per lb., and that mixture at 1s. 8d. per lb. No person in the trade could sell the finest coffee at the price he sold that mixture. Had sold the mixture from twelve to twenty years, and his customers had it in preference to any he sold. They asked for that particular coffee. He paid 1s. 4d. per lb. to the wholesale manufacturers for the mixture; almost every grocer sold the same sort of coffee. The Bench retired to consult, and after an absence of nearly an hour they convicted the defendant in £1. Mr. Townsend asked if the justices had found that there was any fraudulent intention on the part of the defendant. He asked the Bench to state a case. The magistrates unanimously decided to do so.

RECENT CHEMICAL PATENTS.

The following specifications have been recently published, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

No 1882	Name of Patentee.	Title of Patent.	Price
759	J. A. Dixon	Purifying Anthrachinone and Alizarines	2d.
1392	D. Graham & H. J. Smith	Incandescent Electric Lamps	2d.
1393	F. B. Rawes	Obtaining Sulphur	8d.
1400	T. E. Gatehouse	Incandescent Electric Lamps	2d.
1405	J. W. Urquhart	Electric Gas Igniting Apparatus	2d.
1412	O. E. Woodhouse & F. Rawson	Electric Lighting	6d.
1444	R. Werdermann	Electric Incandescent Lighting Apparatus	6d.
1455	G. Molloy	Secondary Batteries for Storage of Electricity	2d.
1461	E. Turpin	Manufacture of Explosive Compound	4d.
1462	S. Waters	Electric Lamps	2d.
1464	F. de Lalande	Electric Piles or Batteries	4d.
1548	W. B. Brain	Secondary Batteries	6d.
1556	J. S. Williams	Generation, Storage, &c., of Electricity	1s. 4d.
1561	J. Walter	Purifying Coal Gas	4d.
1570	W. Jeffery	Electric Arc Lamps	6d.
1580	Sir D. Salomons	Electric Lamps	6d.
1587	A. Tribe	Secondary Batteries	4d.
1614	W. R. Lake	Magneto or Dynamo Electric Machines	6d.
1626	J. Munro	Electric Light and Power Appliances	8d.
1630	J. B. Spence and A. Watt	Obtaining Caustic Soda and Chlorine by the Decomposition of Saline Solutions	4d.
1647	St. G. L. Fox	Incandescent Electric Lamps	6d.
1670	J. Jameson	Incandescent Electric Lamps	4d.
1683	L. Mond	Manufacture of Peroxide of the Alkalies, Alkaline Earths and Hydrogen and the Application of the same	6d.
1689	G. S. Young and R. J. Hatton	Electric Lamps	6d.
1690	P. C. Gilchrist & S. G. Thomas	Manufacture of Nickel	2d.
1692	D. T. Piot	Dynamo Electric or Magneto Electric Machines	6d.
1697	Hon. R. Brougham and F. A. Ormiston	Incandescent Electric Lamps	6d.
1721	F. M. Lyte	Manufacture of Lead Peroxide	4d.
1725	F. C. Glaser	Manufacture of Soap	4d.
1728	B. J. Young	Manufacturing Glycerine from Soap Liquor	4d.
1769	J. H. Johnson	Secondary Batteries	6d.
1774	A. Muirhead	Electric Circuits	6d.
1817	J. H. Johnson	Obtaining Crystallizable Sugar from Raw Sugar	2d.
3881	F. R. Welles	Electric Lamps and Conductors therefor	6d.

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; Journal of Applied Science; The Provisioner; The Practitioner; New Remedies; Proceedings of the American Chemical Society; Le Praticien; The Inventors' Record; New York Public Health; The Scientific American; Society of Arts Journal; Sanitary Engineer of New York; The Chemists' Journal; Weekly Drug News; Sugar Cane; Country Brewers' Gazette; The Medical Record; The Canada Lancet; Gas and Water Engineering; The Grocers' Gazette; Columbia School of Mines Quarterly Magazine London Water Supply, by Crookes, Odling and Tidy; Chemical Review.